APPENDIX A

Responsibility for Consent Decree Obligations after Sale or Transfer of the Facility and Passage of the 180-Day Period of Joint and Several Liability

Section	Provision	Defendant Retains / Obligation does not transfer to new owner or operator	Defendant Relieved / Obligation transfers to new owner or operator
IV. CIVIL PENALTY	Civil Penalty - Mobil shall pay a civil penalty of $350,000, plus interest at 1.29 percent per year from the date of August 21, 2003.	X	
V. COMPLIANCE MEASURES	Main Flare Emission Limits		X
	Monitoring - measure and record the H_2S concentration in the field gas at the Facility in each calendar month at the inlet to the Main Flare, and shall continuously measure and record the volume of gas combusted in the Main Flare.		X
	Operation and Maintenance of Flare Devices and Compressors		X
	Root Cause Analysis		X Note: ceases to be required upon issuance of the final PSD and Title V permits.
	Root Cause Analysis - Corrective Action		X Note: ceases to be required upon issuance of the final PSD and Title V permits.
	Permitting	X Apply for the permits within the required time frame.	X Comply with ongoing permit requirements.
VI. SUPPLEMENTAL ENVIRONMENTAL PROJECT	Pay for and complete all obligations of the SEP.	X	
VII. COMPLIANCE REPORTING AND RECORDKEEPING	Quarterly compliance reports, emission calculations.		X

VIII. STIPULATED PENALTIES	Late or incomplete payment of civil penalty.	X	
VIII. STIPULATED PENALTIES (Cont.)	Other provisions related to ongoing compliance.		X
IX. RIGHT OF ENTRY			X
X. FORCE MAJEURE			X
X. DISPUTE RESOLUTION			X
XI. NOTIFICATION			X

APPENDIX B

MCELMO CREEK UNIT OPERATIONS & MAINTENANCE PLAN

OCTOBER 2004

MCELMO CREEK UNIT OPERATIONS & MAINTENANCE PLAN

CONTENTS

I. Process Overview and Operating Procedures

The McElmo Creek Compression Plant serves tertiary recovery operations for the McElmo Creek Field. The goal of the Plant is to receive produced gas through a gathering system, pressure the gas up to a suitable working pressure then re-inject the gas to maintain reservoir pressure. The natural gas is injected with produced water in a dual injection system. Due to varying water injection demands in the field, and to the number of wells being serviced at any time, the Plant inlet volume can vary between 10 and 18 million standard cubic feet per day (MSCFD).

To describe the plant process in more detail, the gas is processed in three main steps: inlet separation, compression and re-injection.

Inlet Separation. The inlet separation consists of an inlet slug receiver which collects free liquids. The gas then passes through filter vessels which collect any incoming solids.

Compression. The Plant consists of four high-speed electrically-driven reciprocating compressors which utilize 6300 Brake Horsepower (BHP). Each compressor consists of four stages which raise the pressure of the incoming gas from 40 psig to 2900 psig. Each stage has a dedicated aerial cooler and liquid scrubber vessel. On the largest compressor, inter stage dehydration takes place to remove water for corrosion mitigation.

Isolation and operating procedures for the Acid Gas A&B and HOS 4 and HOS 6 compressors are included in the appendix to this report.

Re-Injection. The four units discharge into a single header, where purchased CO2 is co-mingled to achieve a daily injection goal of 24 MSCFD. The gas is then distributed to the field. During Plant upsets, additional CO2 is purchased to meet the daily injection goal.

During Plant upsets or compressor downtime events, a portion or all of the inlet volume to the Plant is automatically diverted to flare until the problem is corrected.

II. Routine Monitoring / Surveillance

The plant is manned 24 hours a day by operators who work 12-hour shifts. The operators make plant rounds each shift, during which key operating parameters of the compressors and supporting equipment are monitored. The following are examples of the parameters that are recorded during a shift:

- Overall Plant inlet and discharge volumes
- CO2 purchased volumes
- Flared volumes
- Discharge pressure
- Compressor run times

From the Operator's daily run time report (example attached in appendix to this report), a compressor reliability spreadsheet and flare volume report are updated.

The Operators monitor key operating parameters for the compressors to ensure the units are operating within prescribed operating limits based on ExxonMobil and original equipment manufacturer (OEM) standards. Examples of parameters that the Operators record include:

- Compressor suction and discharge temperatures and pressures
- Scrubber liquid levels

The detailed parameters that are checked during the shift are included in the maintenance plan and operating procedures included in the appendix to this report.

The operators are very familiar with prescribed operating limits, as this is part of their training. Should the operator observe a parameter that is out of specification, appropriate corrective action is taken. For example, if compressor suction temperature is too low, the operator will open cooler louvers to adjust. If the Operator cannot resolve the issue through organized troubleshooting, he then contacts Plant Engineering, Maintenance and Reliability (M&R) Supervisor and/or the contract mechanic to resolve the problem.

III. Maintenance Plan

ExxonMobil utilizes an Equipment Strategies Program (ESP) approach to ongoing reliability improvements. The ESP includes the following items:

1. Periodic maintenance that will be performed on the equipment.
2. Predictive maintenance that is to be done on the equipment.
3. Equipment life cycle
4. Overhaul schedule
5. Spare parts inventory

The appendix to this report contains the specific steps in the Life Cycle Maintenance Plan for the McElmo equipment strategy developed for these types of compressor units. The ESP is applied to the compression equipment and the reliability efficiency of the compressors is measured. The process consists of Periodic Maintenance, Predictive

Maintenance, Equipment Life Cycle and Overhaul Schedule and the Life Cycle Maintenance Model which describes the various levels within the program and how they are applied.

A. Periodic Maintenance (PM's)

Periodic maintenance begins with daily inspections of the compressors, which are performed by the Plant Operator. In addition to monitoring process parameters, the following daily equipment checks are made:

- The compressor piping, inter stage coolers and block valves and compression valves are inspected for fluid leaks
- Oil and water levels are monitored
- Vibration levels on the motors and compressor frames are monitored
- General observations of physical conditions (i.e., unusual sounds) of the compressor and electric motor are noted.

Additional periodic maintenance includes:

- Compressor performance analysis (Beta)
- Lube oil analysis data to determine the condition of the electric motor, compressor and all of the auxiliary equipment.
- Foundations and equipment mounts are checked for cracks and correct make-up torque.
- Compressor Piping is inspected for external damage
- Corrosion coupons are pulled and monitored

Annual Inspections involve performing functional tests on the instrument and controls systems. This includes testing safety devices, vibration probes, safety alarms and safety shutdowns. There are PM's frequencies that extend past a year, such as coolant replacement and lube oil replacement. The predictive maintenance is the tool that is used to decide if this work is required.

B. Predictive Maintenance

Predictive maintenance involves performing detailed inspections for internal wear. The inspections reveal the remaining life of a compressor component. Some examples of the predictive maintenance include inspecting the compressor main bearings, compressor cylinder and piston inspections, electric motor winding/insulation inspection, crankshaft web deflections and electric motor bearing inspection.

The results of predictive maintenance inspections are recorded, trended and used to determine when the next major maintenance is due.

C. Equipment Life Cycle and Overhaul Schedule

The Equipment Strategy Program assists in determining the life cycle for the compressors. This life cycle information and the data taken during the predictive maintenance helps us determine when the electric motor and compressor should be overhauled. An overhaul involves opening up the machine and replacing all worn parts with new or refurbished parts. Overhauls can take up to one month or more to complete. The compressor is restored as much as possible and another life cycle begins. The common practice is to hire additional contract mechanics to perform this work. A normal life cycle for a McElmo compressor is 40,000 hours. This equates to the compressor and electric motor being overhauled about every 5 to 6 years. Overhauls are recorded and all of the data and measurements kept on file. These files are kept on site and with the contractor that performed the work.

D. Life Cycle Maintenance Model

The section below provides a description of the type of activities planned for each Level. Note Levels 5 and 6 are subject to the Risk Based Work Selection process prior to committing to the work. The Risk Based Work Selection process is based on earlier and ongoing data obtained and analyzed during the maintenance cycles.

LEVEL 1 OPERATIONS SURVEILLANCE AUTONOMOUS MAINTENANCE
Collection and review of process parameters along with routine observation of machinery operations.

LEVEL 2 RUNTIME BASED TESTING PREDICTIVE MAINTENANCE
Scheduled collection and monitoring of both crankcase lubricant for effects of degradation.

LEVEL 3 CONDITION MONITORING PREDICTIVE MAINTENANCE
Scheduled analysis of the engine and compressor performance, vibration profile, and energy utilization.

LEVEL 4 INTERMEDIATE INTERVENTION PREVENTIVE MAINTENANCE
Scheduled driver tune-up and testing /reconditioning of safety devices. Minimally invasive, downtime required.

LEVEL 5 PREEMINENT INTERVENTION PREVENTIVE MAINTENANCE
Scheduled inspection / reconditioning of minor wear components in both the driver and driven equipment. A suite of maintenance task considerations and milestone targets that are subject to Risk Based Work Selection review prior to execution.

LEVEL 6 ZERO HOUR TURNAROUND PREVENTIVE MAINTENANCE
Scheduled overhaul of driver and replacement of major wear components. A suite of maintenance task considerations and milestone targets that are subject to Risk Based Work Selection review prior to execution.

IV. Training Program for Plant Operators

NEW OPERATIONS PERSONNEL - NO PRIOR MCELMO PLANT EXPERIENCE

The plant training for new operations persons with no prior McElmo ReInjection Plant experience consists of the following:

- Training for one month with another Plant Operator in the ReInjection Plant. Trainee must be scheduled for only day shifts until qualified.
  - Training will be conducted on the following:
    - Plant operation, start up, shutdown and emergency procedures
    - Surveillance requirements for plant operations personnel
    - First line maintenance responsibilities
    - Regulatory requirements, such as upset reporting and regulatory documentation
    - Required safe work practices, permits and methods used
    - Required communication procedures, including handling of community inquiries

- The Plant Supervisor will evaluate the individual's performance and is required to approve the trainee for release from the training program
- Following the training program the first shifts must be scheduled during day shift

OPERATOR WITH PRIOR PLANT EXPERIENCE (Out of the Plant >1 year)

- Ensure all ongoing required training has been completed and reviewed
- Review all procedures, including plant operation, start up, shutdown and emergency procedures
- Work with another Operator for one week during day shift
- The Plant Supervisor will evaluate the individual's performance and is required to approve the trainee for release from the training program

OPERATOR TRAINING ON CONSENT DECREE

Following the effective date of the Consent Decree existing operators will be trained on the following sections of the Consent Decree. New operators will be trained on these sections as part of their overall plant training while the consent decree is in effect:

- Paragraph 9a - Emission Limits as it relates to their duties
- Paragraph 10 - Monitoring as it relates to their duties
- Paragraph 11 - Contents of the O&M plan as it relates to their duties
- Paragraph 12 - Root Cause Analysis as it relates to their duties
- Paragraph 31 - Right of Entry as it relates to their duties

V. Reference Documentation

The following documentation is readily available at the facility:

- Startup and isolation procedures for each unit (copies included in the appendix of this report)
- Original Equipment Manufacturer (OEM) maintenance manuals for each unit
- Piping and instrument diagrams (P&ID's) for the plant, updated to reflect DESOP review in May 2003
- Operating limits tables for each compressor, compiled from OEM recommendations and ExxonMobil practices (copies included in the operating procedures in the appendix of this report)
- All operator log sheets
- Compressor Troubleshooting Guide (copies included in the appendix of this report)

VI. Appendices

1. Life Cycle Maintenance Plan McElmo Compressors
   HOS 6, HOS 4, ACID GAS A&B

2. Daily Plant Reading Form

3. Isolation and Operating Procedures
   HOS 6, HOS 4, ACID GAS A&B

4. Compressor Troubleshooting Guide

5. Spare Parts List - HOS 4 and HOS 6

APPENDIX 1

Life Cycle Maintenance Plan
McElmo Compressors

HOS 6, HOS 4, ACID GAS A&B

The following pages describe the Level 1 tasks performed by the plant operators during each shift.

Critical monitoring devices for pressure, temperature, level, and vibration are equipped with High and High High alarms. High alarms warn operators of a process malfunction allowing operators to troubleshoot the process for operational or mechanical malfunctions. Operational problems are corrected by an operator allowing equipment to continue operating. Mechanical problems that can be easily repaired by the operator are repaired. Mechanical problems that cannot be repaired by the operator are communicated to the supervisor on duty and a decision is made to either shut down that piece of equipment or to continue running, depending on the criticality of the equipment and/or the severity of the malfunction, until repairs can be made. Monitoring frequency of the equipment will be increased, again depending on the criticality of the equipment or the severity of the malfunction until repairs can be made.

High High alarms will automatically shutdown equipment ensuring the safety of personnel, preventing damage to equipment, and minimizing impact on the environment. The supervisor on duty is notified of a shutdown and a decision is made whether to repair immediately, depending on day (weekend, weekday), time of day(night tour or day tour) availability of parts and personnel necessary to perform repairs, in order to minimize impact on the environment.

Routine Monitoring / Preventative Maintenance Plan

MAINTENANCE PLAN				
HOS 6				
LEVEL 1	**OPERATION SURVEILLANCE**			
TASK	**TASK DESCRIPTION**	**ACTIVITY**	**FREQUENCY**	**SKILL**
	COMPRESSOR			
L1-T1	1ST SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T2	1ST DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T3	2ND SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T4	2ND DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T5	3RD SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T6	3RD DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T7	4TH SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T8	4TH DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T9	JACKET WATER LEVEL	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T10	JACKET WATER PRESSURE	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T11	JACKET WATER TEMP IN / OUT	CHECK TEMP	12 HOURS	OPERATIONS
L1-T12	FRAME OIL LEVEL	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T13	COMP OIL PRESSURE	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T14	LUBE OIL LEVEL UCON - 1	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T15	HI / LO LUBE OIL PRESSURE (FOR CYLINDERS)	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T16	VIBRATION ON 1ST STAGE WEST/EAST	CHECK VIBRATION	12 HOURS	OPERATIONS
L1-T17	VIBRATION ON 2ND STAGE WEST/EAST	CHECK VIBRATION	12 HOURS	OPERATIONS
L1-T18	VIBRATION ON 3RD STAGE	CHECK VIBRATION	12 HOURS	OPERATIONS
L1-T19	VIBRATION ON 4TH STAGE	CHECK VIBRATION	12 HOURS	OPERATIONS
L1-T20	VIBRATION ON MOTOR WEST / EAST (GEARBOX)	CHECK VIBRATION	12 HOURS	OPERATIONS

L1-T21	VIBRATION ON MOTOR (GEARBOX)	CHECK VIBRATION	12 HOURS	OPERATIONS
	SCRUBBERS			
L1-T22	1ST / 2ND STAGE SCRUBBERS	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T23	3RD / 4TH STAGE SCRUBBERS	CHECK LEVEL	12 HOURS	OPERATIONS

MAINTENANCE PLAN				
HOS 4				
LEVEL 1	**OPERATION SURVEILLANCE**			
TASK	**TASK DESCRIPTION**	**ACTIVITY**	**FREQUENCY**	**SKILL**
	COMPRESSOR			
L1-T1	1ST SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T2	1ST DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T3	2ND SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T4	2ND DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T5	3RD SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T6	3RD DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T7	4TH SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T8	4TH DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T9	JACKET WATER LEVEL	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T10	JACKET WATER PRESSURE	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T11	JACKET WATER TEMP IN / OUT	CHECK TEMP	12 HOURS	OPERATIONS
L1-T12	FRAME OIL LEVEL	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T13	COMP OIL PRESSURE (OFF CONTROL PANEL)	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T14	LUBE OIL LEVEL UCON - 1	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T15	HI / LO LUBE OIL PRESSURE (FOR CYLINDERS)	CHECK	12 HOURS	OPERATIONS
L1-T16	AFTERCOOLER FAN ON HI / LO	CHECK TEMP	12 HOURS	OPERATIONS
L1-T17	VIBRATION ON MOTOR NW & SW	CHECK VIBRATION	12 HOURS	OPERATIONS
L1-T18	VIBRATION ON MOTOR NE & SE	CHECK VIBRATION	12 HOURS	OPERATIONS
L1-T19	VIBRATION ON 1ST / 2ND STAGE	CHECK VIBRATION	12 HOURS	OPERATIONS
L1-T20	VIBRATION ON 3RD / 4TH STAGE	CHECK VIBRATION	12 HOURS	OPERATIONS

L1-T21	VIBRATION ON COMPRESSOR WEST	CHECK VIBRATION	12 HOURS	OPERATIONS
	SCRUBBERS			
L1-T22	1ST / 2ND STAGE SCRUBBERS	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T23	3RD / 4TH STAGE SCRUBBERS	CHECK LEVEL	12 HOURS	OPERATIONS

MAINTENANCE PLAN				
ACID GAS A AND ACID GAS B				
LEVEL 1	**OPERATION SURVEILLANCE**			
TASK	**TASK DESCRIPTION**	**ACTIVITY**	**FREQUENCY**	**SKILL**
	COMPRESSOR			
L1-T1	1ST SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T2	1ST DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T3	2ND SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T4	2ND DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T5	3RD SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T6	3RD DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T7	4TH SUCTION	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T8	4TH DISCHARGE	CHECK TEMP & PRESSURE	12 HOURS	OPERATIONS
L1-T9	JACKET WATER LEVEL (NORTH END & SOUTH END)	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T10	JACKET WATER PRESSURE	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T11	FRAME OIL LEVEL	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T12	COMP OIL PRESSURE (OFF CONTROL PANEL)	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T13	LUBE OIL LEVEL UCON - 1	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T14	HI / LO LUBE OIL PRESSURE (FOR CYLINDERS)	CHECK PRESSURE	12 HOURS	OPERATIONS
L1-T15	AFTERCOOLER FAN ON HI / LO	CHECK TEMP	12 HOURS	OPERATIONS
	SCRUBBERS			
L1-T16	1ST / 2ND STAGE SCRUBBERS	CHECK LEVEL	12 HOURS	OPERATIONS
L1-T17	3RD / 4TH STAGE SCRUBBERS	CHECK LEVEL	12 HOURS	OPERATIONS

NOTE LEVELS 2 THROUGH 6 ARE THE SAME FOR ALL COMPRESSORS

LEVEL 2	SERVICE TIME BASED TESTING			
TASK	TASK DESCRIPTION	ACTIVITY	FREQUENCY	SKILL
L2-T1	LUBE OIL ANALYSIS	TEST	740 HOURS	MECHANICAL
L2-T2	JACKET WATER ANALYSIS	TEST	4000 HOURS	MECHANICAL

LEVEL 3	CONDITION MONITORING			
TASK	TASK DESCRIPTION	ACTIVITY	FREQUENCY	SKILL
L3-T1	MOTOR-COMPRESSOR PERFORMANCE ANALYSIS	ANALYZE	QUARTERLY	MECHANICAL
L3-T2	HORSE POWER UTILIZATION RATIO	ANALYZE	QUARTERLY	MECHANICAL
L3-T3	VIBRATION COMPRESSOR DRIVE MOTOR BEARINGS	ANALYZE	QUARTERLY	MECHANICAL
L3-T4	VIBRATION PRE / POST LUBE OIL PUMP	ANALYZE	QUARTERLY	MECHANICAL
L3-T5	LOOSE FOUNDATION FASTENERS / CHOCKS	VISUAL INSPECTION	QUARTERLY	MECHANICAL
L3-T6	PRESSURE CASE VENT PIPING	VISUAL INSPECTION	QUARTERLY	MECHANICAL
L3-T7	COMPRESSOR JACKET WATER PIPING	VISUAL INSPECTION	QUARTERLY	MECHANICAL

LEVEL 4	INTERMEDIATE INTERVENTION			
TASK	TASK DESCRIPTION	ACTIVITY	FREQUENCY	SKILL
L4-T1	COMPRESSOR CRITICAL SAFETY DEVICES	TEST	QUARTERLY	INSTRUMENT
L4-T2	MOTOR BEARING GREASE	LUBRICATE	QUARTERLY	MECHANCIAL
L4-T3	CRANKCASE AND DRIVE TRAIN	VISUAL INSPECTION	QUARTERLY	MECHANICAL
L4-T4	JACKET WATER-LUBE OIL COOLER BANK FAN BELT	REPLACE	QUARTERLY	MECHANICAL
L4-T5	LUBE OIL FILTERS	REPLACE	REPLACE AS NEEDED PER ANALYSIS	MECHANICAL
L4-T6	CRANKCASE LUBE OIL	REPLACE	REPLACE AS NEEDED PER ANALYSIS	MECHANICAL
L4-T7	CRANKCASE LUBE OIL SUMP	CLEAN	AS NEEDED PER ANALYSIS	MECHANICAL
L4-T8	CRANKCASE LUBE OIL FEED LINES	VISUAL INSPECTION	AS NEEDED	MECHANICAL
L4-T9	JACKET WATER-LUBE OIL COOLER BANK (EXTERNAL)	CLEAN	AS NEEDED	MECHANICAL
L4-T10	GAS COMPRESSOR ROD (SCORING)	VISUAL INSPECTION	ANNUAL	MECHANICAL
L4-T11	GAS COMPRESSOR PACKING CASE (ROD CENTERING)	VISUAL INSPECTION	ANNUAL	MECHANICAL
L4-T12	GAS COMPRESSOR WIPER PACKING (LEAKAGE)	VISUAL INSPECTION	ANNUAL	MECHANICAL
L4-T13	GAS COMPRESSOR PACKING CASE (LUBE CONNECTIONS)	VISUAL INSPECTION	ANNUAL	MECHANICAL
L4-T14	CROSSHEAD SHOE CLEARANCE	CHECK & RECORD	ANNUAL	MECHANICAL
L4-T15	TORQUE COMPRESSOR CRANK FRAME FOUNDATION FASTENERS	CHECK & RECORD	ANNUAL	MECHANICAL
L4-T16	TORQUE COMPRESSOR CYLINDER DISTANCE PIECE FASTENERS	CHECK & RECORD	ANNUAL	MECHANICAL
L4-T17	TORQUE CRITICAL CRANKCASE FASTENERS	CHECK & RECORD	ANNUAL	MECHANICAL
L4-T18	GAS COMPRESSOR ROD RUNOUT	CHECK & RECORD	ANNUAL	MECHANICAL
L4-T19	MOTOR WINDING POLARIZATION INDEX	TEST & RECORD	25000 HOURS	VENDOR SERVICE
L4-T20	MOTOR LEAD CONNECTIONS	INSPECT & TORQUE	25000 HOURS	VENDOR SERVICE
L4-T21	MOTOR CONTACTOR	TEST & INSPECT	25000 HOURS	VENDOR SERVICE

LEVEL 4	INTERMEDIATE INTERVENTION			
TASK	TASK DESCRIPTION	ACTIVITY	FREQUENCY	SKILL
L4-T22	MOTOR CONTACTOR BUS STAB	INSPECT & LUBRICATE	25000 HOURS	VENDOR SERVICE
L4-T23	SUPERVISORY RELAYS	CALIBRATE & INSPECT	25000 HOURS	VENDOR SERVICE
L4-T24	MOTOR GROUND WIRE / CONNECTIONS	INSPECT & TORQUE	25000 HOURS	MECHANICAL

LEVEL 5	PREEMINENT INTERVENTION			
TASK	TASK DESCRIPTION	ACTIVITY	FREQUENCY	SKILL
L5-T1	MAIN BEARING CLEARANCE	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T2	CONNECTING ROD BEARING CLEARANCE	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T3	CROSSHEAD PIN CLEARANCE	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T4	GAS COMPRESSOR ROD PRESSURE PACKING CASE	INSPECT & RECONDITION	36000 HOURS	MECHANICAL
L5-T5	GAS COMPRESSOR WIPER PACKING	INSPECT & RECONDITION	36000 HOURS	MECHANICAL
L5-T6	GAS COMPRESSOR ROD PROFILE	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T7	PROFILE COMPRESSOR CYLINDER LINER	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T8	COMPRESSOR VALVES AND CAGES	INSPECT & RECONDITION	36000 HOURS	MECHANICAL
L5-T9	FORCE FEED LUBRICATOR SYSTEM	INSPECT & SERVICE	36000 HOURS	MECHANICAL
L5-T10	CRANKCASE RELIEF DOORS	RECONDITION	36000 HOURS	MECHANCIAL
L5-T11	COMPRESSOR ROD RUNOUT	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T12	CRANKSHAFT WEB DEFLECTION	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T13	DRIVE MOTOR BASE BOLT TORQUE	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T14	CRANKSHAFT THRUST BEARING	CHECK & RECORD	36000 HOURS	MECHANICAL
L5-T15	GAS COMPRESSOR PISTON, ROD, NUT (BALANCE)	WEIGHT & RECORD	36000 HOURS	MECHANICAL
L5-T16	MOTOR DRIVE COUPLING	CHECK & RECORD	36000 HOURS	MECHANICAL

LEVEL 6	ZERO HOUR OVERHAUL			
TASK	TASK DESCRIPTION	ACTIVITY	FREQUENCY	SKILL
L6-T1	MAIN BEARINGS	REPLACE	72000 HOURS	MECHANICAL
L6-T2	CONNECTING ROD BEARINGS	REPLACE	72000 HOURS	MECHANICAL
L6-T3	CONNECTING ROD BUSHINGS	REPLACE	72000 HOURS	VENDOR SERVICE
L6-T4	CROSSHEAD PIN	INSPECT	72000 HOURS	MECHANICAL
L6-T5	CROSSHEAD SHOES	INSPECT	72000 HOURS	MECHANICAL
L6-T6	JACKET WATER PUMP	RECONDITION	72000 HOURS	MECHANICAL
L6-T7	MAIN OIL PUMP	RECONDITION	72000 HOURS	VENDOR SERVICE
L6-T8	CRANKSHAFT OIL SEAL	REPLACE	72000 HOURS	MECHANICAL
L6-T9	MAIN LUBE OIL PUMP COUPLING	INSPECT	72000 HOURS	MECHANICAL
L6-T10	CRANKSHAFT THRUST BEARING	CHECK	72000 HOURS	MECHANICAL
L6-T11	OIL THERMOSTAT ELEMENTS	CHECK	72000 HOURS	MECHANICAL
L6-T12	JACKET WATER THERMOSTAT ELEMENTS	REPLACE	72000 HOURS	MECHANICAL
L6-T13	GAS COMPRESSOR VALVE COVER STUDS	INSPECT	72000 HOURS	MECHANICAL
L6-T14	GAS COMPRESSOR HEAD STUDS	INSPECT	72000 HOURS	MECHANICAL

APPENDIX 2

Daily Plant Reading Form

ExxonMobil - Four Corners

Daily Plant Reading

McElmo Creek Reinjection Facility

NAME:

DATE: **DATE REPORTING FOR:**

UNIT	R/T Hrs	Stdy By	Unsch D / T	Schd D / T	Reason for Downtime
4245 (HOSS-6)					
4246 (A.G.C.-A)					
4247 (A.G.C.-B)					
4249 (HOSS-4)					

TOTAL FLOW	METER ID	VOLUMES
Plant Inlet	FI 1999 "P"	
Inlet Bypass	FI 9999 "P"	
	TOTAL	
Plant Flare	FI2083 "P"	
	Total Reinjection	

MCU CO2 PURCHASE (Micro Motion) Mtr Reading	
TODAY'S Readings	
YESTERDAY'S Readings	
TOTAL	
TOTAL COMPRESSOR VOL	
TOTAL INJECTION	
DISCHARGE PRESSURE	
HEADER PRESSURE	

(Dynamic-Micro Mtr.) CO2 K-M Meter Reading	
TODAY'S Readings	
YESTERDAY'S Readings	

TEXACO CO2 (MICRO-MOTION) METER READING	
TODAY'S READING	
YESTERDAY'S READING	
TOTAL	

P-9201 YESTERDAY'S CUMULATIVE FLOW	P-9202 YESTERDAY'S CUMULATIVE FLOW	TOTAL INJECTION	
YESTERDAY'S (Booster Station) MAKE UP READING	TODAY'S (Booster Station) MAKE UP READING	TOTAL MAKE UP	TOTAL PRODUCED
YESTERDAY'S RUNTIME P-9201	TODAY'S RUNTIME P-9201	TOTAL RUNTIME P-9201	
YESTERDAY'S RUNTIME P-9202	TODAY'S RUNTIME P-9202	TOTAL RUNTIME P-9202	DISCHARGE PRESSURE

COMMENTS:								

APPENDIX 3

Isolation and Operating Procedures for:

HOS 6, HOS 4, ACID GAS A&B

SCOPE This procedure describes the isolation, depressurization and returning of the HOS-6 Compressor back to service.

REQUIREMENTS None

APPLICABLE DOCUMENTS HOS-6 Compressor Opearting Procedure
Pre-Start Safety Review Checklist (See Attachment)

SPECIAL EQUIPMENT None

ENVIRONMENTAL For environmental concerns, contact the Field Foreman and the Operations Compliance Technician.

SAFETY **Locks must be used by Operations and Maintenance Personal**

For applicable safety requirements, refer to the ExxonMoibl Production Safety Manual and Material Safety Data Sheets (MSDS).

Care must be taken to completely depressure the compressor which may contain explosive or sour gas.

Safety devices taken out of service or being returned to service MUST be logged in the Critical Safety Device (CSD) log book in the Control Room.

All valves, switches and breakers referenced in this procedure MUST BE LOCKED AND TAGGED per the Lock-out / Tag-out guidelines.

1. Isolate the compressor for maintenance.

NOTE	Refer to the HOS-6 Operating procedure for requirements to shutdown the compressor. This procedure is for total compressor isolation. Dependant upon the maintenance work required, specific cylinders or utilities may be isolated separately, while leaving the remaining cylinders or utilities in service.

1.1 Ensure that the pre-lube oil pump is not running.

1.2 De-energize the electrical breaker for the motor in the MCC building.

1.3 Close the 4th stage discharge isolation block valve.

1.4 Close the 3rd stage suction valve downstream of the Glycol Contactor.

1.5 Close the 4th stage intercooler discharge block valve.

1.6 Close the 1st stage suction isolation block valves (SDC-1700)

- Change setpoint to zero on DCS PCV-1700,

1.7 Close all isolation block valves on the PSV's rack for the (1st, 2nd, 3rd and 4th stages,etc)

1.8 Close the isolation block valve on the 1st Stage Suction Scrubber.

1.9 Close all isolation block valves for the closed drain

1.10 Close all isolation block valve for the open drain.

1.11 Place the H2S and LEL Detection system in the "calibration" mode in the Control Room.

NOTE	While the H2S and LEL Detection system is in the "calibration" mode, the sensors are still active and MUST be monitored from the Control Room. Tag it with Pink BYPASS tag and Log in the LOG BOOK .

2. Depressurize the compressor for maintenance.

WARNING **Atmospheric vents will release process gas that contains LEL and H2S.**

2.1 Open the blowdown valves on all stages to the Flare header to depressure the compressor.

2.2 Close the blowdown valves on all stages to the Flare header.

2.3 Open the atmospheric vent valves on all 4 cylinder stages to verify depressurization.

2.4 Open the cylinder head and crank end vent valves to verify that the cylinders to be worked on are depressured.

2.5 Notify maintenance that they may begin their work.

3. Pressure check compressor.

WARNING **Make sure all maintenance work is completed before returning the compressor to service.**

3.1. Pressure check compressor with process gas.

3.1.1 Close the atmospheric vent valves on all 4 cylinder stages.

3.1.2 Open all isolation block valves on the PSV's for the (1st, 2nd, 3rd and 4th stages,etc.)

3.1.3 Open all isolation block valve for the closed drain.

3.1.4 Open all isolation block valve for the open drain.

WARNING **Make sure atmospheric vents are closed before pressurizing compressor with process gas.**

3.1.5 Open the 4th stage discharge isolation block valve.

3.1.6 Open the 3rd stage suction valve downstream of the Glycol Contactor.

3.1.7 Open the 4th stage intercooler discharge block valve.

3.1.8 Open the 1st stage suction isolation block valves (PCV-1700, SDV-1700).

3.1.9 Verify pressures across compressor.

3.1.10 Verify that no leaks are detected on all items worked.

4. Return compressor to service.

4.1. Refer to the HOS-6 Operating procedure for requirements on returning the compressor back into service

SCOPE This procedure describes the startup and shutdown of the HOS-6 compressor. Applicable steps are initial startup, normal startup, normal operation, temporary operation, emergency operation, normal shutdown, Emergency Shutdown (ESD), safety shutdown, problems and solutions, and operating limits.

REQUIREMENTS None

APPLICABLE DOCUMENTS HOS-6 Compressor Isolation Procedure

SPECIAL EQUIPMENT None

ENVIRONMENTAL For environmental concerns, contact the Field Foreman and the Operations Compliance Technician.

SAFETY For applicable safety requirements, refer to the ExxonMobil Production Safety Manual and Material Safety Data Sheets (MSDS).

1. Initial Startup.

NOTE	Initial startup is performed following an extended compressor shutdown due to maintenance or turnaround.

1.1. Check that the compressor is ready for start.

- ❑ Maintenance work complete
- ❑ Temporary blinds removed and equipment restored
- ❑ Oxygen purged from compressor and piping
- ❑ Compressor and piping pressure checked using process gas
- ❑ Compressor piping rechecked for leaks
- ❑ Compressor isolation valves returned to service
- ❑ Safety devices, vents, and PRVs returned to service
- ❑ Instruments, controls, and electrical power returned to service
- ❑ Lock-out/Tag-out removed

1.2. Start compressor using normal startup procedure.

2. Normal Startup.

NOTE	Normal startup is performed following a brief compressor shutdown due or following an extended shutdown after performing the initial startup checks.

2.1. Prepare the compressor for start.

2.1.1. Check compressor is ready for start.

- ❑ Plant ESD and local panel shutdowns are reset
- ❑ Verify that the LEL, H2S and Fire systems are in normal operation
- ❑ Motor electrical breaker is reset and in service in the MCC building
- ❑ Control panel power on
- ❑ Control panel lights working
- ❑ Crankcase oil level okay
- ❑ Lubricator oil reservoir level okay

- ❑ Jacket water level okay
- ❑ Visually verify that all Suction scrubbers are empty
- ❑ Ensure that the compressor is depressurized
- ❑ Ensure that the manual block valves on the 1st stage suction and 4th stage discharge lines are in the open position
- ❑ Ensure that all kiene valves and bleeder valves are closed
- ❑ The 1st Stage Suction Pressure Controller (PIC-1700) resets automatically to 10.4%

2.2 Start and load compressor.

CAUTION	**The compressor should not have more than 10 psig on the 1st stage suction. Depressure as needed to prevent overloading the compressor motor.**

2.2.1 Start the pre-lube oil pump.

NOTE	The pre-lube oil pump switch is located at the southwest corner of the compressor skid.

2.2.2 Start the 1st, 2nd, 3rd and 4th stage cooler fans.

2.2.3 Start the lube oil cooler fans.

2.2.4 Start the jacket water cooler fans.

2.2.5 Start the jacket water pump.

2.2.6 Press the "red" electrical reset button by Control Panel

2.2.7 Turn the bypass timer clockwise to 5 minutes.

NOTE	Allow the indicators to sequence to "green." The indicators that are bypassed by the timer will not sequence until after startup and the first indicator in the series clears.

2.2.8 Verify discharge valve is open on the 4th stage discharge

WARNING	**If the panel indicator does not rotate from "clear" to "red" indicating that the discharge valve is open, visually inspect the valve position to ensure it is opened.**

Warning: Ensure that all personnel are clear and free of the electrical power supply system components immediately prior to starting motor. In particular do not stand in front of motor starter, near motor transformer or under aerial fuses. A minimum distance of 25 feet should be maintained for unqualified personnel.

Rationale: Across the line motor starting creates approximately 6X full load current. Consequently the electrical system is stressed during starting and the probability of failure is greater.

2.2.9 Press and hold the "green" start button and the "Lube " pump will run for 1 minute before the compressor starts.

CAUTION **After 2 unsuccessful starts; the compressor motor starter will trip a time delay in the MCC building and prevent you from restarting the compressor. Verify the time delay duration in the MCC building.**

2.2.10 Verify that the compressor oil pressure is above 45 psig.

2.2.11 When the compressor starts ups, the suction valve should open automatically and the indicator will show open.

2.2.12 Close the 2nd stage discharge to flare valve (PCV-1746).

CAUTION **Ensure that the Contactor back pressure control valve (PCV-1637) is open before you begin to close the 3rd stage discharge to flare pressure controller (PIC-1747).**

2.2.13 Close the 3rd stage discharge to flare valve (PCV-1747).

2.2.14 The 1st Stage Suction Pressure Controller (PIC-1700) in the "auto" mode with a setpoint 15 psig on the Rosemont DCS.

2.2.15 Reset the bypass timer back to zero.

2.2.16 Start the glycol pumps and place the Dehydration system in service.

3. Normal Operation.

3.1. See tables at end of procedure for normal operating parameters. (Page 9 of 10)

3.2. Perform daily rounds, including but not limited to the items below:

- Troubleshoot, acknowledge, reset, and clear compressor alarms
- Check compressor normal operating parameters
  - Suction and discharge pressures
  - Suction and discharge temperatures
  - Cylinder temperatures

- Cylinder vibration
- Motor Vibration
- Crankcase and lubricator lube oil pressure
- Crankcase and lubricator lube oil temperature
- Crankcase lube oil filter dp, and change as necessary
- Crankcase oil level
- Oil consumption
- Lubricator oil level
- Jacket water pressure
- Jacket water temperature

- Check compressor crankcase and lubricator lube oil level and fill as needed
- Check pulsating bottle supports
- Check vibration and temperature monitors
- Clean oil off skid and foundation
- Check packing vent temperatures
- Check crankcase pressure
- Check all gauges
- Check for lose bolting
- Check Jacket water tank level and fill as needed
- Check Jacket water pump and cooler fans for proper operation
- Check suction scrubber levels and drain manually if needed
- Drain suction and discharge pulsating bottles
- Check distance piece purge or vent system
- Check interstage cooler delta pressure and temperature
- Check motor bearing oil sump level and sight level condition
- General housekeeping duties

- Check compressor aftercooler fans operation

4. Temporary Operation.

NOTE	Use of temporary operating procedures must be approved by the Field foreman.

4.1. Document any temporary procedure changes with a Management of Change (MOC) work order, and a procedure revision request form.

4.2 Follow up on temporary procedures when the system is returned to normal operation or when a temporary procedure becomes permanent. Complete all documentation required.

5. Emergency Operation.

5.1. Refer to *Emergency Response Plan* for emergency response instructions.

6. Normal Shutdown.

NOTE	Normal shutdown is usually done for compressor maintenance or when inlet gas rates decrease. Control Room operator will coordinate any normal shutdown.

6.1. Shut down compressor.

6.2.1. Press the Motor stop button.

6.2.2 Ensure suction valve is closed since this valve closes automatically.

6.2.3 Open the 3rd stage discharge to flare valve (PCV-1747).

6.2.4 Open the 2nd stage discharge to flare valve at (PCV-1746).

NOTE	Turn off the associated pumps and cooler fans if the compressor will be down for an extended period.

7. Emergency Shutdown (ESD)

NOTE	ESD of the Gas Reinjection Facility can be initiated from any of the 7 pull stations located throughout the facility or from 1 push button station located in the Control Room. The Fire, H2S and LEL detection systems will also initiate an ESD. Both systems will shutdown all the reinjection compressors, isolate the inlet area and depressure the facility.

NOTE	The ESD pull stations located throughout the facility are easily identified by the red and white stripes painted on the building or pipe rack support beams.

7.1. Reinjection Facility ESD:

7.1.1. ESD Station One push button station is located inside the Control Room above the Fire, H2S and LEL Detection System's readout panel and a pull station is located on the southeast wall inside the MCC building (beside the Control Room).

7.1.2. ESD Station Located on a pipe rack support beam on the southeast corner of the Acid Gas compressor building.

7.1.3. ESD Station Located outside between the Control Room and the MCC building.

7.1.4. ESD Station Located on the north wall outside of the Inlet Area's Air Compressor building.

7.1.5. ESD Station Located on a building support beam on the northwest corner of the HOS-6 Compressor building.

7.1.6. ESD Station: Located on a building support beam on the northwest corner of the HOS-4 Compressor building.

7.1.7. ESD Station: Located on cooler fan support beam on the southeast corner of the HOS-4 Compressor's Cooler Fan bay.

7.2 Fire, H2S and LEL Detection Systems ESD:

7.2.1. Fire: There are 10 Fire Detection sensors located throughout the facility. Any detection by either of these sensors will initiate an audible alarm and a shutdown of all reinjection compressors, isolate the inlet area and depressure the facility.

7.2.2. H2S: There are 23 H2S Detection sensors located throughout the facility. Any detection by either of these sensors at 10 PPM H2S will initiate an audible alarm and illuminate a "blue" beacon light. Any detection by either of these sensors at 50 PPM H2S will initiate an audible alarm, illuminate a "blue" beacon light and shutdown all reinjection compressors, isolate the inlet area and depressure the facility

7.2.3. LEL: There are 8 LEL Detection sensors located throughout the facility. Any detection by either of these sensors at 30 % LEL will initiate an audible alarm. Any detection by either of these sensors at 50 % LEL will initiate an audible alarm and shutdown all reinjection compressors, isolate the inlet area and depressure the facility

7.3 HOS-6 Compressor ESD.

7.3.1 Local ESD. Trip individual compressor ESD by pressing 'Stop' button on local control panel to shut down that compressor only.

8. Safety Shutdown.

8.1 Any condition below causes a safety shutdown of the compressor:

- Plant ESD
- Fire, H2S, and LEL Detection systems
- Low instrument air pressure
- Electrical power failure
- Low discharge pressure
- Low pressure suction
- High discharge pressure on either of the 2nd or 4th stage cylinders
- High level in either of the 1st, 2nd, 3rd or 4th stage suction scrubbers
- Low pressure suction on either of the 2nd, 3rd or 4th stage
- Low compressor oil pressure
- Low compressor oil level
- No flow compressor cylinder oil
- Low pressure Jacket Water
- Cooler failure
- Vibration Compressor
- Compressor manual shutdown

8.3. See critical operating limits tables at end of procedure for safety shutdown trip points.

9. Problems and Solutions.

NOTE	Refer to the Compressor Troubleshooting guide located in the Control Room.

10. Operating Limits.

10.1. Shutdown resets:

Local Shutdown Resets and Permissive

Tag	Description	Position	Setpoint
Reinjection Plant ESD	Total Reinjection Plant ESD	Reset	N/A
Fire Detection	Fire Detection	Reset	N/A
H2S Detection	H2S Detection	Reset	50 PPM
LEL Detection	LEL Detection	Reset	50 %

Remote Shutdown Resets

Tag	Description	Position	Setpoint
Manual Shutdown	Local panel shutdown	Reset	N/A

10.2. Normal operating parameters:

NOTE	The following parameters are only guidelines. Certain conditions may call for you to operate outside them.

HOS-6 Compressor Normal Operating Parameters

Description	Operating Range
Crankcase Oil Pressure	50 to 65 psig
Crankcase Oil Temperature	150 to 170 °F
Oil Filter Differential Pressure	0 to 5 psig
Jacket Water Temperature	100 to 110 °F
Jacket Water Temperature Change	10 °F
1st Stage Suction Temperature	45 to 100 degrees F
1st Stage Discharge Temperature	250 to 280 degrees F
2nd Stage Suction Temperature	80 to 110 degrees F
2nd Stage Discharge Temperature	250 to 280 degrees F
3rd Stage Suction Temperature	100 to 120 degrees F
3rd Stage Discharge Temperature	250 to 280 degrees F
4th Stage Suction Temperature	100 to 120 degrees F
4th Stage Discharge Temperature	240 to 280 degrees F
1st Stage Suction Pressure	14 to 16 psig
1st Stage Discharge Pressure	95 to 105 psig
2nd Stage Suction Pressure	90 to 105 psig
2nd Stage Discharge Pressure	370 to 380 psig
3rd Stage Suction Pressure	350 to 380 psig
3rd Stage Discharge Pressure	1000 to 1050 psig
4th Stage Suction Pressure	1000 to 1040 psig
4th Stage Discharge Pressure	2750 to 2950 psig
1st Stage Vibration (Cyl #1)	0.38 to 0.40 in/s
1st Stage Vibration (Cyl #3)	0.36 to 0.40 in/s
2nd Stage Vibration (Cyl #2)	0.38 to 0.44 in/s
2nd Stage Vibration (Cyl #4)	0.38 to 0.44 in/s
3rd Stage Vibration (Cyl #5)	0.34 to 0.38 in/s
4th Stage Vibration (Cyl #6)	0.35 to 0.40 in/s
Motor Vibration (All Bearings)	2.0 to 3.0 in/s

SCOPE This procedure describes the isolation, depressurization and returning of the HOS-4 Compressor back to service.

REQUIREMENTS None

APPLICABLE DOCUMENTS HOS-4 Compressor Operating Procedure
Pre-Start Safety Review Checklist

SPECIAL EQUIPMENT None

ENVIRONMENTAL For environmental concerns, contact the Field Foreman and the Operations Compliance Technician.

SAFETY **Locks must be used by Operations and Maintenance Personal (Two Sets)**

For applicable safety requirements, refer to the ExxonMobil Production Safety Manual and Material Safety Data Sheets (MSDS).

Care must be taken to completely depressure the compressor which may contain explosive or sour gas.

Safety devices taken out of service or being returned to service MUST be logged in the Critical Safety Device (CSD) log book in the Control Room.

WARNING	**All valves, switches and breakers referenced in this procedure MUST BE LOCKED AND TAGGED per the Lock-out / Tag-out guidelines.**

1. Isolate the compressor for maintenance.

NOTE	Refer to the HOS-4 Operating procedure for requirements to shutdown the compressor.

1.1 Ensure that the lube oil pump is not running.

1.2 De-energize the electrical breaker for the motor in the MCC building.

1.3 Place the local control panel power switch in the "off" position.

1.4 Close the 4th stage discharge isolation block valve.

1.5 Close the 1st stage suction isolation block valve.

1.6 Close the isolation block valves for the closed drain

1.7 Close the isolation block valve for the open drain.

1.8 Place the H2S and LEL Detection system in the "calibration" mode in the Control Room.

NOTE	While the H2S and LEL Detection system is in the "calibration" mode, the sensors are still active and MUST be monitored from the Control Room.

2. Depressurize the compressor for maintenance.

WARNING	**Atmospheric vents will release process gas that contain LEL and H2S.**

2.1 Open the 1/2 blowdown valve to the Flare header to depressure the compressor.

2.2 Open the 3/4 blowdown valve to the Flare header to depressure the compressor.

2.3 Close the 1/2 blowdown valve to the Flare header after depressurizing the compressor.

2.4 Close the 3/4 blowdown valve to the Flare header after depressuring the compressor.

2.5 Close the main isolation block valve to the Flare header.

2.6 Open the atmospheric vent valves on all 4 cylinder stages to verify depressurization.

2.7 Open the cylinder head and crank end vent valves to verify that the cylinders to be worked on are depressured.

2.8 Notify maintenance that they may begin their work.

3. **Pressure check compressor.**

WARNING	**Make sure all maintenance work is completed before returning the compressor to service.**

3.1. Pressure check compressor with process gas.

3.1.1 Open the main isolation block valve to the Flare header.

3.1.2 Close the atmospheric vent valves on all 4 cylinder stages.

3.1.3 Open the isolation block valve for the close drain.

3.1.4 Open the isolation block valve for the open drain.

WARNING	**Make sure atmospheric vents are closed before pressurizing compressor with process gas.**

3.1.5 Open the isolation block valve for the 1st stage suction.

3.1.6 Open the 1st stage suction valve from the local control panel to pressurize the compressor.

3.1.7 Verify pressures across compressor.

3.1.8 Verify that no leaks are detected on all items worked.

4. **Return compressor to service.**

4.1. Refer to the HOS-4 Operating procedure for requirements on returning the compressor back into service

SCOPE This procedure describes the startup and shutdown of the HOS-4 compressor. Applicable steps are initial startup, normal startup, normal operation, temporary operation, emergency operation, normal shutdown, Emergency Shutdown (ESD), safety shutdown, problems and solutions, and operating limits.

REQUIREMENTS None

APPLICABLE DOCUMENTS HOS-4 Compressor Isolation Procedure

SPECIAL EQUIPMENT None

ENVIRONMENTAL For environmental concerns, contact the Field Foreman and the Operations Compliance Technician.

SAFETY For applicable safety requirements, refer to the ExxonMobil Production Safety Manual and Material Safety Data Sheets (MSDS).

Care must be taken to completely purge out a compressor which may contain an explosive mixture of gas.

1. Initial Startup.

NOTE	Initial startup is performed following an extended compressor shutdown due to maintenance or turnaround.

1.1. Check that the compressor is ready for start.

- ❑ Maintenance work complete
- ❑ Temporary blinds removed and equipment restored
- ❑ Oxygen purged from compressor and piping
- ❑ Compressor and piping pressure checked using process gas
- ❑ Compressor piping rechecked for leaks
- ❑ Compressor isolation valves returned to service
- ❑ Safety devices, vents, and PRVs returned to service
- ❑ Instruments, controls, and electrical power returned to service
- ❑ Lock-out/Tag-out removed

1.2. Start compressor using normal startup procedure.

2. Normal Startup.

NOTE	Normal startup is performed following a brief compressor shutdown due or following an extended shutdown after performing the initial startup checks.

2.1. Prepare the compressor for start.

2.1.1. Check compressor is ready for start.

- ❑ Plant ESD and local panel shutdowns are reset
- ❑ Verify that the LEL, H2S and Fire systems are in normal operation
- ❑ Motor electrical breaker is reset and in service in the MCC building
- ❑ Control panel power on
- ❑ Manual switch is in the "on" position for the Murphy Mark III annunciator

- ❑ Reset the Bentley-Nevada vibration monitors
- ❑ Control panel lights working
- ❑ Enclosure pressure indicator for the Control panel is in the safe zone
- ❑ Crankcase oil level okay
- ❑ Lubricator oil reservoir level okay
- ❑ Jacket water level okay
- ❑ Verify that all Suction scrubbers are empty, both visually and on the Rosemont DCS
- ❑ Ensure that the compressor is depressurized
- ❑ Ensure that the manual block valves on the 1st stage suction and 4th stage discharge lines are in the open position
- ❑ Ensure that all kiene valves and bleeder valves are closed
- ❑ Permissive to startup HOS-4 on the Rosemont DCS
- ❑ The 1st Stage Suction Pressure Controller (PIC-3411) is placed in manual with an output of 9.4% open on the Rosemont DCS

2.2 Start and load compressor.

2.2.1 Open the 1 / 2 bypass valve by turning the VO-3412 controller counter-clockwise for a zero psig output.

2.2.2 Open the 3 / 4 bypass valve by turning the VO-3414 controller counter-clockwise for a zero psig output.

NOTE	The 1 / 2 blowdown valve (VO-3462) automatically opens when the compressor is shutdown.

2.2.3 Press the reset button on the Murphy Mark III (timer is for 5 minutes).

2.2.4 Open the 3 / 4 blowdown valve by turning the VO-3424 controller counter-clockwise for a zero psig output.

2.2.5 Press the "lube oil pump on" button.

2.2.6 Press the "Jacket water pump on" button.

2.2.7 Press the "Fan # 1 on" button.

2.2.8 Press the "Fan # 2 on" button.

NOTE	Fan # 2 can be started on either low or high speed based on ambient temperature. Use low speed if the ambient temperature is below 75 degrees F. Use high speed if the ambient temperature is above 75 degrees F.

2.2.9 Press the "open discharge valve" button.

WARNING	**If the panel light does not come on indicating that the discharge valve is open, visually inspect the valve position to ensure it is opened.**

2.2.10 Press and hold the "open suction valve" button until the "open" indication light comes on.

2.2.11 Allow the compressor to purge for a minimum of 30 seconds.

2.2.12 Press the "close suction valve" button.

2.2.13 Press the "close 1 / 2 blowdown valve" (VO-3462) button.

2.2.14 Close the 3 / 4 blowdown valve by turning the VO-3424 controller clockwise for at least a 40 psig output.

2.2.15 Press and hold the "Yellow PPS-3416" button.

NOTE	This will complete the start permissive sequence and illuminate the "Ready to Start" light.

2.2.16 Press the "motor start" button while still pressing the "Yellow PPS-3416" button.

NOTE	You have 5 minutes to place the 1st Stage Suction Pressure Controller (PIC-3411) in "auto" on the Rosemont DCS or the compressor will shutdown.

CAUTION	**After 2 unsuccessful starts; the compressor motor starter will trip a time delay in the MCC building and prevent you from restarting the compressor. Verify the time delay duration in the MCC building.**

2.2.17 Verify that the compressor oil pressure is above 45 psig.

2.2.18 Press and hold the "open suction valve" button until the "open" indication light comes on.

2.2.19 Close the 1 / 2 bypass valve by turning the VO-3412 controller clockwise for at least a 40 psig output.

2.2.20 Close the 3 / 4 bypass valve by turning the VO-3414 controller clockwise for at least a 40 psig output.

2.2.21 Press the "Timer 0" button on the Murphy Mark III annunciator.

2.2.22 Set the 1st Stage Suction Pressure Controller (PIC-3411) in the "auto" mode with a setpoint between 22 to 27 psig on the Rosemont DCS.

3. Normal Operation.

3.1. See tables at end of procedure for normal operating parameters.

3.2. Perform daily rounds, including but not limited to the items below:

- Troubleshoot, acknowledge, reset, and clear compressor alarms
- Check compressor normal operating parameters
  - Suction and discharge pressures
  - Suction and discharge temperatures
  - Cylinder temperatures
  - Lube oil pressure
  - Lube oil filter dp
  - Lube oil temperature
  - Crankcase oil level
  - Lubricator oil level
  - Jacket water pressure
  - Jacket water temperature
- Check compressor lube oil level and fill as needed
- Check Jacket water tank level and fill as needed
- Check Jacket water pump and cooler fans for proper operation
- Check suction scrubber levels and drain manually if needed
- General housekeeping duties
- Check compressor aftercooler fans operation

4. Temporary Operation.

NOTE	Use of temporary operating procedures must be approved by the Field foreman.

4.1. Document any temporary procedure changes with a Management of Change (MOC) work order, and a procedure revision request form.

4.2 Follow up on temporary procedures when the system is returned to normal operation or when a temporary procedure becomes permanent. Complete all documentation required.

5. Emergency Operation.

5.1. Refer to *Emergency Contingency Plan* for emergency response instructions.

6. Normal Shutdown.

NOTE	Normal shutdown is usually done for compressor maintenance or when inlet gas rates decrease. Control Room operator will coordinate any normal shutdown.

6.1. Shut down compressor.

6.2.1. Press main motor 'stop' button.

6.2.2 Press the "close suction valve" button.

6.2.3 Press the "close discharge valve" button.

6.2.4 Open the 1 / 2 bypass valve by turning the VO-3412 controller counter-clockwise for a zero psig output.

6.2.5 Open the 3 / 4 bypass valve by turning the VO-3414 controller counter-clockwise for a zero psig output.

6.2.6 Open the 3 / 4 blowdown valve by turning the VO-3424 controller counter-clockwise for a zero psig output.

NOTE	Turn off the associated pumps and cooler fans if the compressor will be down for an extended period.

7. Emergency Shutdown (ESD)

NOTE	ESD of the Gas Reinjection Facility can be initiated from any of the 7 pull stations located throughout the facility or from 1 push button station located in the Control Room. The Fire, H2S and LEL detection systems will also initiate an ESD. Both systems will shutdown all the reinjection compressors, isolate the inlet area and depressure the facility.

NOTE	The ESD pull stations located throughout the facility are easily identified by the red and white stripes painted on the building or pipe rack support beams.

7.1. Reinjection Facility ESD:

7.1.1. ESD Station One push button station is located inside the Control Room above the Fire, H2S and LEL Detection System's readout panel and another pull station is located on the southeast wall inside the MCC building (beside the Control Room).

7.1.2. ESD Station Located on a pipe rack support beam on the southeast corner of the Acid Gas compressor building.

7.1.3. ESD Station Located outside between the Control Room and the MCC building.

7.1.4. ESD Station Located on the north wall outside of the Inlet Building Air Compressor building.

7.1.5. ESD Station Located on a building support beam on the northwest corner of the HOS-6 Compressor building.

7.1.6. ESD Station Located on a building support beam on the northwest corner of the HOS-4 Compressor building.

7.1.7. ESD Station Located on cooler fan support beam on the southeast corner of the HOS-4 Compressor's Cooler Fan bay.

7.2 Fire, H2S and LEL Detection Systems ESD:

7.2.1. Fire: There are 10 Fire Detection sensors located throughout the facility. Any detection by either of these sensors will initiate an audible alarm and a shutdown of all reinjection compressors, isolate the inlet area and depressure the facility.

7.2.2. H2S: There are 23 H2S Detection sensors located throughout the facility. Any detection by either of these sensors at 10 PPM H2S will initiate an audible alarm

and illuminate a "blue" beacon light. Any detection by either of these sensors at 50 PPM H2S will initiate an audible alarm, illuminate a "blue" beacon light and shutdown all reinjection compressors, isolate the inlet area and depressure the facility

7.2.3. LEL: There are 8 LEL Detection sensors located throughout the facility. Any detection by either of these sensors at 30 % LEL will initiate an audible alarm. Any detection by either of these sensors at 50 % LEL will initiate an audible alarm and shutdown all reinjection compressors, isolate the inlet area and depressure the facility

7.3. HOS-4 Compressor ESD.

7.3.1. Local ESD. Trip individual compressor ESD by pressing 'Stop' button on local control panel to shut down that compressor only.

7.3.2. Remote ESD. Trip compressor ESD on the Rosemont DCS in the Control Room.

8. Safety Shutdown.

8.1. Any condition below causes a safety shutdown of the compressor:

- ESD pull stations
- Fire, H2S, and LEL Detection systems
- Low instrument air header pressure
- Electrical power failure
- Low discharge pressure on either the 1st, 2nd, or 3rd stage cylinders
- High discharge pressure on either the 1st, 2nd, 3rd, or 4th stage cylinders
- High discharge temperature on either of the 1st, 2nd, 3rd or 4th stage cylinders
- High level in either of the 1st, 2nd, 3rd or 4th stage suction scrubbers
- Low 1st stage suction pressure
- High 1st stage suction pressure
- Low compressor oil pressure
- Low compressor oil level
- No flow cylinder lubricator

- Low cylinder lube oil level
- Low water level surge tank
- Cooler fan "A" vibration
- Cooler fan "B" vibration
- Vibration Compressor motor
- Manual shutdown

8.3. See critical operating limits tables at end of procedure for safety shutdown trip points.

9. Problems and Solutions.

NOTE	Refer to the Compressor Troubleshooting guide located in the Control Room.

10. Operating Limits.

10.1. Shutdown resets:

Local Shutdown Resets and Permissives

Tag	Description	Position	Setpoint
Reinjection Plant ESD	Total Reinjection Plant ESD	Reset	N/A
Bentley-Nevada Vibration Monitor	Compressor motor and frame excessive vibration	Reset	N/A
Fire Detection	Fire Detection	Reset	N/A
H2S Detection	H2S Detection	Reset	50 PPM
LEL Detection	LEL Detection	Reset	50 %

Remote Shutdown Resets

Tag	Description	Position	Setpoint
Manual Shutdown	Local panel shutdown	Reset	N/A
Rosemont DCS	HOS-4 Run/Stop	Run	N/A

10.2. Normal operating parameters:

NOTE	The following parameters are only guidelines. Certain conditions may call for you to operate outside them.

HOS-4 Compressor Normal Operating Parameters

Description	Operating Range
1st stage suction pressure	20 to 27 psig
1st stage discharge pressure	65 to 78 psig
2nd stage suction pressure	60 to 78 psig
2nd stage discharge pressure	300 to 330 psig
3rd stage suction pressure	295 to 330 psig
3rd stage discharge pressure	1150 to 1260 psig
4th stage suction pressure	1145 to 1260 psig
4th stage discharge pressure	2750 to 2950 psig
1st stage suction temperature	45 to 105 degrees F
1st stage discharge temperature	250 to 290 degrees F
2nd stage suction temperature	90 to 120 degrees F
2nd stage discharge temperature	275 to 315 degrees F
3rd stage suction temperature	100 to 120 degrees F
3rd stage discharge temperature	275 to 315 degrees F
4th stage suction temperature	105 to 110 degrees F
4th stage discharge temperature	225 to 260 degrees F
Lube oil pressure	45 to 55 psig

SCOPE This procedure describes the isolation, depressurization and returning of the Acid Gas compressor back to service.

REQUIREMENTS None

APPLICABLE DOCUMENTS Acid Gas Compressor Operating Procedure
Pre-Start Safety Review Checklist

SPECIAL EQUIPMENT None

ENVIRONMENTAL For environmental concerns, contact the Field Foreman and the Operations Compliance Technician.

SAFETY **Locks must be used by Operations and Maintenance Personal (Two Sets)**

For applicable safety requirements, refer to the ExxonMobil Production Safety Manual and Material Safety Data Sheets (MSDS).

Care must be taken to completely depressure the compressor which may contain explosive or sour gas.

Safety devices taken out of service or being returned to service MUST be logged in the Critical Safety Device (CSD) log book in the Control Room.

WARNING	**All valves, switches and breakers referenced in this procedure MUST BE LOCKED AND TAGGED per the Lock-out / Tag-out guidelines.**

1. Isolate the compressor for maintenance.

NOTE	Refer to the Acid Gas Compressor Operating procedure for requirements to shutdown the compressor.

1.1 Ensure that the lube oil pump is not running.

1.2 De-energize the electrical breaker for the motor in the MCC building.

1.3 Place the local control panel power switch in the "off" position.

1.4 Close the 4th stage discharge isolation block valve.

1.5 Close the 1st stage suction isolation block valve.

1.6 Close the isolation block valves on the PSV's for the 1st, 2nd, 3rd and 4th stages.

1.7 Close the isolation block valves for the closed drain

1.8 Close the isolation block valve for the open drain.

1.9 Place the H2S and LEL Detection system in the "calibration" mode in the Control Room.

NOTE	While the H2S and LEL Detection system is in the "calibration" mode, the sensors are still active and MUST be monitored from the Control Room.

2. Depressurize the compressor for maintenance.

WARNING	**Atmospheric vents will release process gas that contain LEL and H2S.**

2.1 Open the blowdown valves on all stages to the Flare header to depressure the compressor.

2.2 Close the blowdown valves on all stages to the Flare header.

2.3 Open the atmospheric vent valves on all 4 cylinder stages to verify depressurization.

2.4 Open the cylinder head and crank end vent valves to verify that the cylinders to be worked on are depressured.

2.5 Notify maintenance that they may begin their work.

3. **Pressure check compressor.**

WARNING	**Make sure all maintenance work is completed before returning the compressor to service.**

3.1. Pressure check compressor with process gas.

3.1.1 Close the atmospheric vent valves on all 4 cylinder stages.

3.1.2 Open the isolation block valves on the PSV's for the 1st, 2nd, 3rd and 4th stages.

3.1.3 Open the isolation block valve for the closed drain.

3.1.4 Open the isolation block valve for the open drain.

WARNING	**Make sure atmospheric vents are closed before pressurizing compressor with process gas.**

3.1.5 Open the isolation block valve for the 1st stage suction.

3.1.6 Open the 1st stage suction pressure controller to pressurize the compressor.

3.1.7 Verify pressures across compressor.

3.1.8 Verify that no leaks are detected on all items worked.

4. **Return compressor to service.**

4.1. Refer to the Acid Gas Compressor Operating procedure for requirements on returning the compressor back into service

SCOPE This procedure describes the startup and shutdown of the Acid Gas Compressors "A" and "B" (CM-1201A/B). Applicable steps are initial startup, normal startup, normal operation, temporary operation, emergency operation, normal shutdown, emergency shutdown, safety shutdown, problems and solutions, and operating limits.

REQUIREMENTS None

APPLICABLE DOCUMENTS Acid Gas Compressors "A" and "B" (CM-1201A/B) Isolation Procedure

SPECIAL None

EQUIPMENT

ENVIRONMENTAL For environmental concerns, contact the Field Foreman and the Operations Compliance Technician.

SAFETY For applicable safety requirements, refer to the ExxonMobil Production Safety Manual and Material Safety Data Sheets (MSDS).

Care must be taken to completely purge out a compressor which may contain an explosive mixture of gas.

1. Initial Startup.

NOTE	Initial startup is performed following an extended compressor shutdown due to maintenance or turnaround. Refer to the Acid Gas Compressor isolation procedure when the compressor will be returned to service.

1.1. Check that the compressor is ready for start.

- ☐ Maintenance work complete
- ☐ Temporary blinds removed and equipment restored
- ☐ Oxygen purged from compressor and piping
- ☐ Compressor and piping pressure checked using process gas
- ☐ Compressor piping rechecked for leaks
- ☐ Compressor isolation valves returned to service
- ☐ Safety devices, vents, and PRVs returned to service
- ☐ Instruments, controls, and electrical power returned to service
- ☐ Lock-out/Tag-out removed

1.2. Start compressor using normal startup procedure.

2. Normal Startup.

NOTE	Normal startup is performed following a brief compressor shutdown due or following an extended shutdown after performing the initial startup checks.

2.1. Prepare the compressor for start.

2.1.1. Check compressor is ready for start.

- ☐ Plant ESD and local panel shutdowns are reset
- ☐ Verify that the LEL, H2S and Fire systems are in normal operation
- ☐ Motor electrical breaker is reset and in service in the MCC building under the Control Room.
- ☐ Control panel power on

- ❑ Manual switch is in the "run" position for the Murphy Mark III annunciator
- ❑ Electrical motor oil level
- ❑ Crankcase oil level okay
- ❑ Lubricator oil reservoir level okay
- ❑ Jacket water level okay
- ❑ Visually verify that all Suction scrubbers are empty
- ❑ Ensure that the compressor is depressurized
- ❑ Ensure that all kiene valves and bleeder valves are closed

2.2 Start and load compressor.

NOTE	The compressor should not have more than 10 psig of suction pressure on the 1st stage. If there is more than 10 psig, the pressure should be bled off. This is to prevent overloading the compressor driver.

2.2.1 Start the motor cooling fan (CM-1203).

2.2.2 Start the aftercooler fans (HT-1603, HT-1604, HT-1605, and HT-1606).

2.2.3 Ensure the 1st stage suction valve is manually closed.

2.2.4 Reset the Murphy switch gauges high/low shut down. Turn the Murphy switch qauge (low) to zero setting.

2.2.5 Zero out the timer on the Murphy Mark III on the annunciator panel.

2.2.6 Verify and manually opens the 4th stage discharge valves.

NOTE	Ensure that the 4th Stage discharge isolation block valve located on the south side of the compressor building is open.

2.2.7 Press the main motor 'start' button.

2.2.8 1 minute Pre-Lube

CAUTION	**After 2 unsuccessful starts; the compressor motor starter will trip a time delay in the MCC building and prevent you from restarting the compressor.**

2.2.9 Manually open the 1st stage suction valve.

NOTE	At 200 psig, the 4th stage blowdown valve to flare will close automatically.

Reset all murphy switches shut down setpoint to normal shut down setting on panel.

NOTE	Murphy switch gauges on local panel not to exceed the PSV's setting

3. Normal Operation.

3.1. See tables at end of procedure for normal operating parameters.

3.2. Perform daily rounds, including but not limited to the items below:

- Troubleshoot, acknowledge, reset, and clear compressor alarms
- Check compressor normal operating parameters
  - Suction and discharge pressures
  - Suction and discharge temperatures
  - Cylinder temperatures
  - Lube oil pressure
  - Lube oil filter dp
  - Lube oil temperature
  - Crankcase oil level
  - Lubricator oil level
  - Jacket Water Pressure (3)
  - Jacket Water temperature
- Check compressor lube oil level and fill as needed
- Check Jacket Water tank level and fill as needed
- Check Jacket Water pump and cooler for proper operation
- Check suction scrubber levels and drain level as needed
- General housekeeping duties
- Check aftercooler fans operation

- Check all 4-sides electrical motor oil level

4. Temporary Operation.

NOTE	Use of temporary operating procedures must be approved by the Field foreman.

4.1. Document a temporary procedures with a management of change (MOC) work order, procedure revision request, and/or safety devices jumpering log book.

4.2 Follow up on temporary procedures when the system is returned to normal operation or when a temporary procedure becomes permanent. Complete all documentation required.

5. Emergency Operation.

5.1. Refer to *Emergency Contingency Plan* for emergency response instructions.

5.2. See this procedure for emergency shutdown (ESD) instructions.

6. Normal Shutdown.

NOTE	Normal shutdown is usually done for compressor maintenance or when inlet gas rates decrease. Control Room operator will coordinate any normal shutdown.

6.1. Shut down compressor.

6.2.1. Press main motor 'stop' button.

NOTE	On any Acid Gas compressor shutdown, the blowdown valves to flare will open and depressure the compressor.

6.2.2 Manually block in the 1st stage suction valve.

6.2.3 Manually block in the 4th stage discharge valve. (Maintenances)

6.2.4 Wait 10 to 15 minutes, then turn off the motor cooling fan.

7. Emergency Shutdown (ESD)

NOTE	ESD of the Gas Reinjection Facility can be initiated from any of the 7 ESD pull stations located throughout the facility or from 1 push button station located in the Control Room. The Fire, H2S and LEL detection systems will also initiate an ESD. Both systems will shutdown all the reinjection compressors, isolate the inlet area and depressure the facility.

NOTE	The ESD pull stations located throughout the facility are easily identified by the red and white stripes painted on the building or pipe rack support beams.

7.1. Reinjection Facility ESD:

7.1.1. ESD Station One push button station is located inside the Control Room above the Fire, H2S and LEL Detection System's readout panel and a pull station is located on the southeast wall inside the MCC building (beside the Control Room).

7.1.2. ESD Station Located on a pipe rack support beam on the southeast corner of the Acid Gas compressor building.

7.1.3. ESD Station Located outside between the Control Room and the MCC building.

7.1.4. ESD Station Located on the north wall outside of the Inlet Building of Air compressor .

7.1.5. ESD Station Located on a building support beam on the northwest corner of the HOS-6 Compressor building.

7.1.6. ESD Station: Located on a building support beam on the northwest corner of the HOS-4 Compressor building.

7.1.7. ESD Station: Located on cooler fan support beam on the southeast corner of the HOS-4 Compressor's Cooler Fan bay.

7.2 Fire, H2S and LEL Detection Systems ESD:

7.2.1. Fire: There are 10 Fire Detection sensors located throughout the facility Any detection by either of these sensors will initiate an audible alarm and a shutdown of all reinjection compressors, isolate the inlet area and depressure the facility.

7.2.2. H2S: There are 23 H2S Detection sensors located throughout the facility. Any detection by either of these sensors at 10 PPM H2S will initiate an audible alarm and illuminate a "blue" beacon light. Any detection by either of these sensors at

50 PPM H2S will initiate an audible alarm, illuminate a "blue" beacon light and shutdown all reinjection compressors, isolate the inlet area and depressure the facility

7.2.3. LEL: There are 8 LEL Detection sensors located throughout the facility. Any detection by either of these sensors at 30 % LEL will initiate an audible alarm. Any detection by either of these sensors at 50 % LEL will initiate an audible alarm and shutdown all reinjection compressors, isolate the inlet area and depressure the facility

7.3. Acid Gas Compressor ESD.

7.3.1. Local ESD. Trip individual compressor ESD by pressing 'Stop' button on local control panel to shut down that compressor only.

8. Safety Shutdown.

8.1. Any condition below causes a safety shutdown of the compressor:

- ESD pull stations
- Fire, H2S, and LEL Detection systems
- Low instrument air header pressure
- Electrical power failure
- Low discharge pressure on either the 1st, 2nd, 3rd or 4th stage cylinders
- High discharge pressure on either the 1st, 2nd, 3rd, or 4th stage cylinders
- High discharge temperature on either of the 1st, 2nd, 3rd or 4th stage cylinders
- High level in either of the 1st, 2nd, 3rd or 4th stage suction scrubbers
- Low 1st stage suction pressure
- High 1st stage suction pressure
- Crank case oil pressure
- Oil level low
- No flow cylinder lubricator on either of the 1st, 2nd, or 3rd stage cylinders
- No flow cylinder lubricator on the 4th stage cylinder
- Low cylinder lube oil level

- Jacket Water 1st, 2nd, 3rd low pressure
- Jacket Water pressure
- Low Jacket Water Tank level # 1
- Low Jacket Water Tank level # 2
- Vibration
- Manual shutdown

9. Problems and Solutions.

NOTE	Refer to the Compressor Troubleshooting guide located in the Control Room.

10. Operating Limits.

10.1. Shutdown resets:

Local Shutdown Resets and Permissives

Tag	Description	Position	Setpoint
Reinjection Plant ESD	Total Reinjection Plant ESD	Reset	N/A
Fire Detection	Fire Detection	Reset	N/A
H2S Detection	H2S Detection	Reset	50 PPM
LEL Detection	LEL Detection	Reset	50 %

Remote Shutdown Resets

Tag	Description	Position	Setpoint
Manual Shutdown	Local panel shutdown	Reset	N/A

10.2. Normal operating parameters:

NOTE	The following parameters are only guidelines. Certain conditions may call for you to operate outside them.

Acid Gas Compressor Normal Operating Parameters

Description	Operating Range
1st stage suction pressure	18 to 20 psig
1st stage discharge pressure	90 to 100 psig

2nd stage suction pressure	85 to 100 psig
2nd stage discharge pressure	400 to 410 psig
3rd stage suction pressure	395 to 410 psig
3rd stage discharge pressure	1150 to 1250 psig
4th stage suction pressure	1145 to 1250 psig
4th stage discharge pressure	2750 to 2950 psig
1st stage suction temperature	45 to 100 degrees F
1st stage discharge temperature	230 to 250 degrees F
2nd stage suction temperature	90 to 100 degrees F
2nd stage discharge temperature	270 to 280 degrees F
3rd stage suction temperature	110 to 125 degrees F
3rd stage discharge temperature	270 to 280 degrees F
4th stage suction temperature	110 to 125 degrees F
4th stage discharge temperature	270 to 280 degrees F
Lube oil pressure	45 to 55 psig
Jacket water pressure	20 to 25 psig
Crankcase lube oil pressure	60 to 90 psig

APPENDIX 4

Compressor Troubleshooting Guide

COMPRESSOR TROUBLESHOOTING GUIDE

I. ENGINE & FRAME SHUTDOWNS

II. COOLING SYSTEM SHUTDOWNS

III. GAS CIRCUIT SYSTEM SHUTDOWS

IV. IGNITION & PANEL BOARD

Shutdown on Low Engine/Frame Oil Pressure
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Low Oil Level (High level can cause foaming, resulting in low pressure.)	1. Check oil level. 2. Add oil as needed. 3. Restart unit.
Dirty Filters	1. Check differential pressure across filters, strainer and cooler. 2. If differential pressure is high, replace filters and strainer; clean cooler.
Oil Pump Malfunction	1. Start unit. 2. Check for normal oil pressure at pumpout. 3. If oil pressure at pump out is low, oil pump is faulty; repair or replace as needed. 4. If air is present, change pump. 5. If oil pressure at header is normal, continue troubleshooting. 6. Check pump suction screen for obstruction. 7. If clogged, clean or replace screen.
Gauge Malfunction	1. Use manometer (test gauge) to check panel gauges for malfunction. 2. Check wiring and tattle tale; repair or replace as needed. 3. Calibrate or replace gauges as needed. 4. Check oil sensing line for pluggage.
Engine is Misfiring	1. Load unit. 2. Use digital or hand-held pyrometer (test gauge) to check for misfires causing unit to bog down. (Statiscope or timing light can be used, if pyrometer is not available.) 3. Check ignition; replace plugs or wire if necessary. 4. Check fuel system; adjust to specs.
Relief Valve Stuck Open or Set Too Low	1. Check relief valve setting and position. 2. Correct as needed.
High Oil Level Caused by Water/Liquid Dilution	1. Check day tank water levels to see if there is a leak in head, gasket or liner. 2. Call Mechanic.

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Low Oil Viscosity	1. Change oil. 2. Check recent oil sample analysis results.
Unit Bogging Down	1. Check chart or meters to verify that suction and discharge are normal. 2. Check for proper oil level in governor. 3. Check for broken or loose linkage; repair or replace as needed.

If low engine/frame oil pressure continues and you have taken all corrective steps, call Mechanic.

Shutdown on High Engine/Frame Oil Temperature
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
High Oil Level	1. Check oil level. 2. Adjust oil level as needed.
Binding or Tightness in Compressor Engine	1. Roll engine and compressor by hand. 2. Check for binding or tightness. 3. If binding or tightness exist, notify Mechanic immediately. Do **NOT** start unit. 4. If no binding or tightness is found, start engine.
Dirty Oil Filters	1. Check differential pressure across filters. 2. Change filter if pressure drop exceeds ExxonMobil parameters.
Clogged or Blocked Oil Cooler	1. Check auxiliary water level. 2. Add coolant as needed. 3. Check pressure and temperature differentials across cooler. 4. Clean or replace oil cooler as needed.
Faulty Gauge	1. Use test gauge or pyrometer to compare pressure and temperature panel gauges. 2. Calibrate or replace gauge as needed. 3. Ensure kill setpoint is set to ExxonMobil parameters.
Amot Valve Not Letting Oil Into Cooler	1. Replace amot valve.
Broken Thermostat	1. Scan piping for temperature variances. 2. Replace thermostat.
Engine Overload	1. Check engine load. 2. Check for misfires. 3. Check timing; adjust to engine specs.
Stuck Oil Thermostat	1. Check for bypass around oil cooler. 2. Replace thermostat.

If high engine/frame oil temperature continues and you have taken all corrective steps, call Mechanic.

Shutdown on High /Low Intake Manifold Pressure Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Faulty Timing	1. Start unit. 2. Use timing light to check timing. 3. Adjust magneto as needed to adjust timing. 4. Check drive for wear.
Damaged Drive Coupling or Figure 8	1. Inspect drive coupling or figure 8 for damage. 2. Repair or replace drive coupling or figure 8 as needed.
Engine is Misfiring	1. Load unit. 2. Use digital pyrometer to check for cylinder temperature variances. 3. Check rpm and engine fuel pressure. 4. Use timing light to check plug firing. • If plug is not firing, refer to "Panel Component Troubleshooting Guide." • If plug is firing, continue to next step. 5. Tap on emission valve to see if it is stuck. 6. Use volt meter to check magneto voltage. 7. Check cannon plug and wiring harness. 8. Repair or replace parts as needed. 9. Check for liquid in fuel.
Ignition Problem	1. Use volt ohm meter to check magneto voltage. ***Note: Voltage should be 150-190 DC (Altronic III) or 120-125 DC (CEC).*** 2. If you have an Altronic III ignition, refer to "Altronic III Ignition Troubleshooting Guide." 3. If you have a CEC ignition, refer to "CEC Ignition Troubleshooting Guide."
Insufficient Fuel Supply	1. Check fuel pressure at Fisher 99 and prechamber pressure on Fisher 95. 2. Set pressure to ExxonMobil parameters or factory specs as needed. 3. Check for liquid in fuel; drain fuel scrubbers or fuel supply lines. 4. Check carburetors; repair or clean diaphragms. 5. Check complete fuel system; set to specs.
Faulty Wires or Coils	1. Check plug wires, coils and all wiring. 2. Replace as needed.

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Engine Overload	1. Check chart or meter for engine overload (caused by excess suction). 2. Start and load unit. 3. Check suction control valve for malfunction, causing sudden increase in suction gas flow. 4. Contact client as needed.
Gauge Malfunction	1. Use manometer to check panel gauges for malfunction. 2. Calibrate or replace gauges as needed.
Load Changes (Suction/Discharge Pressure)	1. Check meters or chart for flow changes. 2. Check recycle and control valves; adjust if possible or notify client of possible problems.
Governor Malfunction/Faulty Linkage	1. Check oil in governor; replace or add oil as needed. 2. Check governor linkage and rod ends; repair or replace as needed.
Panel Malfunction	1. Check panel gauges and tubing to panel for accuracy. 2. Check tubing for obstruction or leak. 3. Replace gauges/tubing as needed.
Turbo Malfunction	1. Check thrust by hand; measure turbo output and balance banks. 2. Replace turbo if thrust is out.
Compressor Packing Leaks	1. Check packing. 2. Replace packing if leaks are present.

If high/low intake manifold pressure continues and you have taken all corrective steps, call Mechanic.

Shutdown on High Manifold Temperature
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Low Auxiliary Water Level	1. Check auxiliary water level. 2. Add coolant as needed. 3. Check for water on skid, indicating cracked pipe/hose or loose connection. 4. Check louvers; adjust as needed.
Belt/Pump Malfunction	1. Check auxiliary water pump and belts. 2. Repair or replace as needed.
Auxiliary Water High Temperature or Low Pressure	1. Start and load unit. 2. Check gauge for auxiliary water pressure. 3. If there is low pressure, replace water pump. 4. Use pyro scanner to check differential temperature across intercooler. • If differential temperature is high, inspect and clean intercooler. 5. Check for air lock in system; bleed air from system. 6. Check main cooler system; check for proper valve position; clean cooler as needed.
Gauge Malfunction	1. Use manometer (test gauge) to check panel gauges for malfunction. 2. Calibrate or replace gauges as needed.
Fuel is Too Rich	1. Adjust fuel system using oxygen meter. 2. Check for liquid.
Engine is Overloaded	1. Check manifold pressure with engine running. 2. Check for gas flow changes.
Wrong Timing Setting	1. Check timing and adjust if needed.
Intake Valve Leak	1. Check individual inlet temperatures to check for leaks. 2. Repair leaks as needed.

If high manifold temperature continues and you have taken all corrective steps, call Mechanic.

Shutdown on Lubrication No Flow
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Insufficient Oil in Lubricator Box	1. Check oil in lube box. 2. Check oil regulator supply to lube box. 3. Repair or replace oil regulator supply in lube box as needed.
Broken Lubricator Drive	1. Ensure gear drive and all couplings are not broken or stripped. 2. Replace drive coupling or chain as needed.
Faulty Lubricators	1. Ensure all lubricators are pumping the proper amount of lubrication drops per minute. 2. Prime or replace lubricator as needed.
Blown Rupture Disc	1. Disconnect lubricator lines at cylinders. 2. Prime Lubricator System with Trebon Gun. 3. If rupture disc continues to blow, replace distribution block and cylinder check valves.
Faulty No-Flow Switch	1. Check lubricator no-flow switch for sensitivity. 2. Adjust sensitivity setting to manufacturer's specifications. 3. Use volt ohm meter to inspect no-flow switch for wiring short. 4. Replace wiring as needed. 5. If grounded wire cannot be found, refer to "Panel Component Troubleshooting Guide."

If no lube flow continues and you have taken all corrective steps, call Mechanic.

Shutdown on High Main Bearing Pressure/Temperature Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Main Bearing Switch Malfunction	1. Use Trebon gun to pressure probe header at switch to 25-45 psi. Hold 30 seconds. • If pressure does not hold, do **NOT** start unit; skip to the main bearing probe rupture (below). • If pressure holds, inspect switch for wiring short or proper contact. 2. Adjust setpoint of main bearing switch. 3. Start unit; panel should clear immediately.
Main Bearing Probe Rupture	1. Do **NOT** start unit. 2. Notify Mechanic immediately for probe replacement and bearing inspection.
Engine Bogging Down	1. Check setpoint on switch; set to specs or ensure setpoint is lower than engine oil pressure kill setpoint. 2. Check ignition and fuel settings; set to specs. 3. Check timing and set to specs.

If high main bearing temperature continues and you have taken all corrective steps, call Mechanic.

Shutdown on Engine Overspeed
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Tachometer Malfunction	1. Start engine and idle. 2. Check magneto voltage with volt ohm meter. 3. If voltage is high or low, inspect magneto for possible malfunction. 4. If magneto is malfunctioning, repair or replace as needed. 5. If voltage is normal, load unit. 6. Use timing light with digital display to determine tachometer accuracy. 7. Replace tachometer if accuracy is still in doubt. 8. Check cannon plug in mag back.
Speed Controller Malfunction	1. Inspect speed controller gauges for proper supply and output. 2. If low supply or output, inspect, repair and/or replace gauges or regulator.
Governor Malfunction	1. Check oil level in governor. 2. Add oil as necessary. 3. Check governor linkage. 4. Replace governor rod ends as needed. 5. Bleed governor or adjust compensating needle to eliminate engine surge.
Old Style Overspeed Switch Malfunction	1. Inspect wiring with volt ohm meter. 2. Replace wiring as needed. 3. Inspect overspeed switch for malfunction or short. 4. Replace switch.
Load Reduction	1. Ensure suction/discharge pressures are within normal ranges. 2. If reduced load is present and unit is running too fast, slow unit to proper rpm; determine cause of load change; inspect pressure kills for proper setting.

If engine overspeed continues and you have taken all corrective steps, call Mechanic.

Shutdown on High Engine/Frame Vibration
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Loose Mounting Bolts	1. Check bolts. 2. Tighten as needed. 3. If engine or frame mounts are loose, call Mechanic for alignment/deflection checks.
Vibration Switch Tripped	1. Roll unit over by hand 4-5 revolutions. 2. Check for binding or noise. 3. Ensure start switch and fuel are off. 4. Roll engine over with starter. 5. Listen for unusual knocking or noise. 6. Reset vibration switch. 7. Ensure no liquid is present in fuel to cause detonation; drain fuel scrubber and check carburetor as needed. 8. Clear panel. 9. Start up unit.
Vibration Switch to Set Too Sensitive	1. Check sensitivity setting. 2. Adjust as needed.
Short in Wire to Panel	1. Check panel: • If panel clears, load unit and monitor closely. • If panel does not clear, continue to next step. 2. Use volt meter to located grounded wire. 3. Replace wire. 4. If grounded wire cannot be found, refer to "Panel Component Troubleshooting Guide."
Broken Valve, Piston or Piston Rod	1. Pull valve caps and inspect or replace valves as necessary. 2. Pull head and inspection doors; inspect crosshead, rod, rod nut and piston. 3. Repair or replace parts as needed.
High Scrubber Level	1. Check scrubber for high liquid level. 2. If liquid is found, replace level controller and repair dump valves.

If high engine/frame vibration continues and you have taken all corrective steps, call Mechanic.

Shutdown on Low Auxiliary Water Pressure
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Low Coolant Level	1. Check coolant level; add coolant as needed. 2. Check for leak on skid; repair leak as needed.
Water Pump/Belt Failure	1. Visually inspect auxiliary water pump and belt for wear and leaks. 2. Replace pump and/or belt as needed.
Blockage in Intercooler	1. Start engine. 2. Check differential temperature and pressure across intercooler. • If temperature differential is high or pressure differential is low, inspect intercooler for possible blockage.
Faulty Gauge	1. Use test gauge to test auxiliary water pressure. 2. Verify pressure on panel board gauge. 3. Calibrate or replace gauge as needed.
Air in System	1. Bleed out on highest point of system and at the top of pump. 2. Check seal in water pump; replace pump as needed.

If low auxiliary water pressure continues and you have taken all corrective steps, call Mechanic.

Shutdown on Low Coolant Level
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Gauge Cocks on Sight Glass are Closed	1. Ensure gauge cocks on sight glass are open and you have true coolant tank reading.
Coolant Leaks	1. Check for loose hoses, fittings or piping causing coolant leaks; repair or replace as needed. 2. Check for leak on skid; repair leak as needed. 3. Check for leaking water ump seal; change water pump if seal is leaking.
Malfunctioning Level Controller on Surge Tank	1. Check level controller float. • If floatis not intact, replace. 2. Check micro-switch on level controller. • Replace micro-switch if defective. 3. Use volt ohm meter to check for shorts in wire. • Replace wire as needed.
Internal Leaks	1. Check crankcase for coolant. 2. Check for head gasket or liner leaking into base. 3. Repair leaks as needed.

If low coolant level continues and you have taken all corrective steps, call Mechanic.

Shutdown on Low Jacket Water Pressure
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Low Coolant Level	1. Check coolant level. 2. Add coolant to proper level as needed. 3. Check for leak on skid; repair leak as needed. 4. Check hoses; repair or replace as needed.
Water Pump/Belt Failure	1. Visually inspect water pump and belts for wear or leaks. 2. Replace pump/belts as needed. 3. Check for coolant leak; check engine base for coolant leak. 4. Repair any leaks found. 5. Start unit. 6. Check jacket water pressure. • If pressure is low, use test gauge to verify panel gauge accuracy. • If pressure is low, replace water pump or belts as needed. 7. Check hoses/couplings on pump inlets. • Repair/Replace parts as needed.
Faulty Gauge	1. Use test gauges to check panel gauges for accuracy. 2. If panel gauge is inaccurate, calibrate or replace gauge.
Faulty Valve Position	1. Ensure proper inlet/outlet valve position.
Cracked Head, Head Gasket or Liner	1. Check crankcase oil level. 2. Check for water in crank case. 3. Drain oil and check for leaking liner. • If leak is found, repair/replace parts as needed.
Air Trapped in System	1. Bleed air at highest point on system. 2. Replace radiator cap with new one.
Plugged/Dirty Cooler	1. Clean cooler coils as needed.

If low jacket water pressure continues and you have taken all corrective steps, call Mechanic.

Shutdown on High Jacket Water Temperature
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Low Coolant	1. Check coolant level. 2. Add coolant to proper level as needed. 3. Check for leak on skid; repair leak as needed.
Water Pump or Belt Failure.	1. Visually inspect water pump, water belts and cooler fan belts for wear or leaks. 2. Replace pump or belts as needed.
Faulty Gauge	1. Start engine. 2. Use test gauges or pyro scanner to check water pressure and temperature gauges. 3. Calibrate or replace gauge as needed.
Low Temperature Differential on Cooler	1. Ensure proper louver position. 2. Check cooler fins for possible blockage. Caution: Use proper lock/tag procedures if you must enter cooler. 3. Remove blockage or wash cooler fins. 4. Check tubes for scale obstructions; clean as needed.
Incorrect Ignition Timing	1. Check ignition timing. 2. Advance or retard timing to ExxonMobil parameters as necessary.
Overload Detonation	1. Check manifold pressure. 2. Check oxygen setting. 3. Check suction/discharge pressures for changes in load or gas flow.
Sticking Thermostats	1. Use pyro scanner on each side of thermostat if possible. 2. Remove thermostats and test in hot water. 3. Repair/replace thermostats as needed.
Fan Blades Need Adjustment	1. Check pitch on fan blades; torque to specs.
Incorrect Antifreeze Mixure	1. Determine if antifreeze is mixed correctly. 2. Check freeze point and pH levels; drain/replace antifreeze as needed.

If high jacket water temperature continues and you have all corrective steps, call Mechanic.

Shutdown on High Cooler Vibration
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Loose Mounting Bolts	1. Check bolts. 2. Tighten as needed.
Vibration Switch Tripped	1. Roll unit over by hand 4 – 5 revolutions. 2. Check for binding or noise. 3. Ensure start switch and fuel are off. 4. Roll engine over with starter. 5. Listen for unusual knocking or noise. 6. Reset vibration switch. 7. Clear panel. 8. Start up unit.
Vibration Switch is Set Too Sensitive	1. Check sensitivity setting. 2. Adjust as needed.
Mechanical Malfunction	1. Visually inspect belts and cooler blades to see if they are loose or damaged. ***Caution: To prevent injury, use lock-out/tag-out procedure if you must enter cooler.*** 2. Tighten, repair or replace belts, bearings or blades.
Wiring or Vibration Switch Malfunction	1. Start unit. 2. Check panel. 3. If panel does not clear, use volt meter to locate grounded wire. 4. Replace wire as needed. 5. If grounded wire cannot be found, refer to "Panel Component Troubleshooting Guide."
Loose Fan Blades	1. Replace fan blades as needed. 2. Check torque; retorque bolts and check blades for proper angle.

If high cooler vibration continues and you have taken all corrective steps, call Mechanic.

Shutdown on High/Low Suction Pressure
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Suction Control Valve Malfunction	1. Start and load unit. 2. Compare suction pressure to reading on previous Operator Report. 3. Check custody charts for high or low suction condition. 4. Adjust control valve or notify client of control valve problem.
Faulty Gauges	1. Use test gauges to check panel gauges for accuracy. 2. Calibrate or replace gauges as needed.
Frozen, Plugged or Broken Lines	1. Thaw sensing lines with methanol. ***Use extreme caution when using methanol. Wear appropriate ppe.*** 2. Replace broken tubing.
Dump Valve Hung Open	1. Check scrubber dumps. 2. Reset dump controller.
Recycle Malfunction	1. Check recycle valve operation. 2. Adjust as needed for proper setting.
Client Production Equipment Problems	1. Check separator pressure. 2. Look for possible equipment problems; notify Field Reliability Specialist as needed.
Intake Screen or Filter Plugged	1. Check differential pressure across filter/screen. 2. Change/Clean filter/screen as needed.

If high/low suction pressure continues and you have taken all corrective steps, call Mechanic.

Shutdown on High Scrubber Level
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Closed Sight Glass Gauge Cocks	1. Ensure sight glass gauge cocks are open. 2. Check for level in sight glass. 3. If there is no level, adjust controller as needed to maintain level.
Level Controller Malfunction	1. Ensure level controller has adequate air supply and gas/air output pressure to dump valve. 2. Check supply regulator for malfunction. • Repair or replace regulator if necessary. 3. Ensure level controller is working properly. 4. Check controller parts; tighten or replace as needed.
Blockage in Dump Valve	1. Check output to dump valve. 2. Ensure dump valve is operational. 3. Remove any blockage in valve. 4. Check for trapped pressure; relieve trapped pressure SLOWLY if possible.
Frozen Dump Lines	1. Check dump line for freezing. 2. Warm lines as needed. Caution: Use extreme caution when warming lines as high pressure is trapped in lines. 3. Check for trapped pressure; relieve trapped pressure SLOWLY if possible.
High Level Shutdown Malfunction	1. Ensure float on high level shutdown is intact. • If flowat is not intact, replace float. 2. Inspect micro-level switch in high level shut-down switch. • Replace shut-down switch as needed.
Short in Wiring	1. Reset panel. 2. If panel will not clear, check for short in wire; replace wire from high level shut-down switch. 3. If grounded wire cannot be found, refer to "Panel Component Troubleshooting Guide."

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Valve Off Skid is Closed	1. Trace piping off skid to find possible closed valve. 2. Open valve if closed. 3. Check for trapped pressure; relieve trapped pressure SLOWLY if possible.
Plugged Dump Line	1. Unscrew piping and remove obstruction if possible. 2. Run coiled cleaner in line. 3. Check for trapped pressure; relieve trapped pressure SLOWLY if possible.
Liquid Carryover in Scrubber	1. Drain customer's air or supply gas.
High Pressure in Customer Tank or Scrubber	1. Ensure pressure of vessel being dumped into is lower than pressure of fluid being dumped.

If high scrubber level continues and you have taken all corrective steps, call Mechanic.

Shutdown on High/Low Interstage Pressure
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Faulty Valve or Rings	1. Start and load unit. 2. Use pyro scanner to check for hot valves or rings. 3. Repair or replace as needed.
Gas Leak	1. Check for relief valve venting. 2. Ensure relief valve socks are in place. 3. Inspect relief valves for possible malfunction. 4. Reset or replace relief valves as needed.
Frozen Cooler or Tubing to Panel Gauges	1. Adjust louvers to warm gas. 2. Inject methanol into tubing lines. ***Caution: Use extreme caution with methanol; high pressure may be trapped in tubing; wear appropriate ppe.***
Faulty Gauges	1. Use test gauge on interstage scrubber to test accuracy against panel board gauge. 2. Calibrate or replace gauges and set kill.
Dump Valves Hung in Open Position	1. Ensure dump valves ae in closed position. 2. Set dump controller for proper.
Load Change	1. Check reycle valve for proper operation; reset as needed. 2. Check meters for flow changes; set kill switch to proper setting.

If high/low interstage pressure continues and you have taken all corrective steps, call Mechanic.

Shutdown on High/Low Discharge Pressure
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
High Dehy or Rack Pressure	1. Check chart or meter run for discharge pressure. 2. If high pressure, contact client to determine cause.
Frozen Pipes or Equipment	1. Open blowdown to release discharge pressure to atmosphere. 2. If nothing exits blowdown, close louvers as needed to warm the cooler. 3. Check pressure on panel gauge to ensure pressure is released. 4. Check for frozen tubing lines: • Disconnect tubing. • Inject methanol into line. Caution: Use extreme caution with methanol; high pressure may be trapped in tubing. 5. Warm pipes as needed.
Relief Valve Malfunction	1. Check relief valve setting. 2. Ensure relief valve socks are in place. 3. Repair or replace relief valve or socks as needed.
Gauge Malfunction	1. Use manometer (test gauge) to check panel gauges for malfunction. 2. Calibrate or replace gauges as needed
Short in Wire in Panel	1. Check panel: • If panel clears, load unit and monitor closely. • If panel does not clear, continue to next step. 2. Use volt meter to locate grounded wire. 3. Replace wire.
Bad Valves or Compressor Ring	1. Ensure temperatures and pressures are within normal ranges. 2. If temperatures and pressures are abnormal, inspect for bad valves, piston rings or piston. 3. Repair/replace parts as needed.
Broken Piping	1. Inspect piping for leaks; repair/replace piping as needed.
Recycle/Dump Valve Malfunction	1. Check recycle/dump valves; adjust as needed.

If high/low discharge pressure continues and you have taken all corrective steps, call Mechanic.

Shutdown on High Discharge Temperature
Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Hot Valves	1. Load unit. 2. Pyro scan valve caps. 3. Repair or replace valves as needed.
High Interstage Temperature	1. Check louver position on cooler. 2. Open louvers as needed to cool gas. 3. Check cooler fins for dirt, dust or other obstructions.
Faulty Gauges	1. Use test gauges on suction/discharge pressure. 2. Calculate suction/discharge temperatures. 3. Calibrate or replace gauges as needed.
Inadequate Lubrication	1. Check lubricator for proper cyliner lubrication. 2. Increase output or replace lubricator as needed.
Cylinder Piston Ring Damage	1. Inspect cylinder piston rings. 2. Replace piston rings as needed.
Low Suction Pressure	1. Check recycle load changes; reset recycle valve. 2. Check suction pressure; calibrate discharge temperature and set kill to proper setting.
High Recycle Rate	1. Check recycle valve and flow. 2. Make adjustments as needed.

If high discharge temperature continues and you have taken all corrective steps, call Mechanic.

Altronic III Ignition Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Faulty Harness Wire	1. Set volt ohm meter to ohms. 2. Disconnect power harness from ignition module. 3. Thoroughly check each harness wire for continuity. • If wires are good, skip to "Faulty Mag Back." • If bad wire is found, change cannon Plug and harness. 4. Start Unit. If unit will not start, continue. 5. Check all terminals for proper grounding. 6. Replace bad electrical connections.
Faulty Mag Back (Back Plates)	1. Set volt ohm meter to DC and check voltage. ***Note: Voltage should be 150-190 DC.*** • If voltage does not meet requirements, change mag back (back plates). 2. Start Unit. If unit will not start, call Mechanic.
Bad Mag Back Drive Gear	1. Check condition of drive gear teeth. 2. If teeth are missing, change figure 8. 3. Change coupling disc.
Broken Roll Pin in Figure 8 or Flange Mount	1. Replace roll pin and damaged parts. 2. Change mad drive adapter.
Oil in Magneto	1. Change seal or magneto (bad mag drive seal on flange mount).
Faulty Wires, Plug or Coils	1. Visually inspect all wires, plugs and coils. 2. Replace any that are damaged.
Faulty Mag	1. Check for proper mag and backs. 2. Check mag drive. 3. Repair or replace as needed.

CEC Ignition Troubleshooting Guide

POSSIBLE CAUSE	CORRECTIVE ACTIONS
Faulty Generator or Magneto Discs	1. Disconnect generator wires to regulator. 2. Set volt ohm meter to volts AC and check voltage. • If voltage meets requirements, skip to "Faulty Regulator." 3. Check condition of drive discs. • Replace discs as needed. • If discs are okay, replace generator. 4. Start unit. If engine will not start, continue to troubleshoot.
Faulty Regulator	1. Reconnect wires from generator to regulator. 2. Disconnect +/- wires from regulator to ignition module. 3. Roll engine over. 4. Set volt ohm meter to volts DC and check voltage out of regulator. ***Note: Voltage should be 10-32 DC.*** • If voltage does not meet requirements ,change regulator. 5. Start unit. If engine will not start, continue to troubleshoot.
Faulty Harness Wire	1. Set meter to ohms. 2. Disconnect power harness from ignition module. 3. Thoroughly check each harness wire for continuity. • If wires are good, skip to "Faulty Harness or Ignition Module." • If bad wire is found, change cannon Plug and harness. 4. Start unit. • If engine will not start, continue to troubleshoot.
Faulty Harness or Ignition Module	1. Set meter to volts DC and check voltage. Note: Voltage should be at least 120 volts DC 2. If voltage doen not meet requirements, change ignition module. 3. Start unit. If engine will not start, notify Mechanic.
Connection Box Wire are Loose	1. Inspect for loose wires or connections. 2. Tighten or replace wires as needed.

APPENDIX 5

Spare Parts List - HOS 4

Spare Parts List - HOS 6

McElmo Creek
Spare Critical Machinery Equipment

SPARE PARTS LIST

McElmo Creek Unit HOS 4 Spare Parts List	
Compressor	Compressor Suction/Discharge Valves
	Oil Filters
	Lubricator Parts
Electric Motor Driver	Thermocouples
	Vibration Probes
Cooler	V-Belts
	Pulleys
	Gaskets and Seal Pins
Instruments and Controls	Temperature Switches
	Pressure Switches
	Instrument Tubing
	Position Indicators
	Pressure Gauges
	Thermometers

* These parts are housed in a multipurpose building on site. The inventory of spares is maintained by logging any part removed and initiating a purchase requisition to replace the part.

SPARE PARTS LIST

McElmo Creek Unit HOS 6 Spare Parts List	
Compressor	Compressor Suction/Discharge Valves
	Piston Rings
	Piston Rods
	Gaskets
	Packing Gland Assembly
	Crosshead Assembly
	Oil Filters
	Lubricator Parts
Electric Motor Driver	Thermocouples
	Vibration Probes
Cooler	V-Belts
	Pulleys
	Gaskets and Seal Pins
Instruments and Controls	Temperature Switches
	Pressure Switches
	Instrument Tubing
	Position Indicators
	Pressure Gauges
	Thermometers

* These parts are housed in a multipurpose building on site. The inventory of spares is maintained by logging any part removed and initiating a purchase requisition to replace the part.

APPENDIX C

Root Cause Failure Analysis Program

Root Cause Failure Analysis

Root cause failure analysis (RCFA) methodology is incorporated into the standard operating procedures in the McElmo Creek Unit field area. It provides a structured format in analyzing an event and helps to determine necessary measures to prevent future occurrences. The RCFA program includes the following components:

Step 1 - Notification

Field supervisor determines that an investigation is warranted and appoints personnel to conduct a root cause failure analysis for each Flaring Incident, except for those Flaring Incidents caused by scheduled maintenance or a CO_2 breakthrough.

Step 2 - Plan Investigation

Once the decision is made to investigate a Flaring Incident, the investigator develops an investigation strategy. To do this an investigator can use the information initially available to develop a preliminary Snap Chart (see attachment). This will help the investigator understand what happened, identify areas where more information is needed, and identify conflicting information.

For each of the causal factors (problems) on the Snap Chart, the investigator can rapidly consider the questions that need to be answered to identify root causes using the Root Cause Tree.

With insight gained from using these two techniques, the investigator or the investigation team can plan the initial investigation strategy by:

- Identifying the key plant parameters and event times that need to be checked to verify the incident's sequence of events and technical accuracy.
- Identifying key pieces of evidence (broken parts, logbooks, chart recorders, computer printouts, etc.) that need to be collected and preserved.
- Requesting copies of the applicable procedures that should have been used during the incident.
- Selecting an initial group of individuals for interviews to fill in gaps in the information or to resolve conflicting information.

Step 3 - Collect Information

Collecting information (interviewing people and analyzing physical evidence) is an ongoing process throughout the investigation and crucial to understanding the incident and why it occurred. The investigator(s) are instructed to consult the TapRoot User Guides for each technique.

Step 4 - Determine Sequence of Events

An investigator or team collects several people's perceptions of what happened during an incident and the problems that were associated with the activities and equipment during an incident. The investigator has to blend these various perceptions into the story of what happened. The best technique for doing this is the Snap Chart.

A Snap Chart is an excellent graphic tool. In developing the Snap Chart, the investigator organizes the information being collected on a graphical chart to better understand it. This organization of the information often causes the re-evaluation of assumptions or facts that conflict with other information. This organization also helps the investigator identify gaps in logic of what happened.

When you have team investigations or if you are interviewing several people at one time, drawing a Snap Chart together helps facilitate gathering everyone's information and increases the effectiveness of meetings or group interviews. During individual interviews, the investigator may find it helpful to sketch a Snap Chart with the interviewee to verify their verbal communication. The investigator should keep a master Snap Chart updated as "facts" are verified.

Step 5 - Identify Incident's Causal Factors

Once the sequence of the incident is thoroughly understood, the investigator needs to identify all the factors that, if eliminated, would have prevented the incident from occurring or would have significantly mitigated its consequences. These factors are called causal factors.

Often investigators can identify the causal factors by simply inspecting the Snap Chart and asking, "If I could remove or correct the problems identified on this chart, which ones would prevent this incident from occurring or make it less severe?" A more formal technique is called Barrier Analysis and is used as an optional approach to identifying the causal factors (which in barrier analysis would be called broken barriers). In the next step, the investigator analyzes each causal factor for its root cause(s) using the Root Cause Tree.

Step 6 - Identify Root Causes

Once the causal factors are identified, the next step is to identify the root causes. This is done using the Root Cause Tree. The Root Cause Tree User's Manual provides questions that help the investigator pinpoint the incident's root causes.

The Human Performance Troubleshooting Guide on the Root Cause Tree helps an investigator decide which human performance related causes need further investigation. It also ensures that experienced investigators consider all potential causes of human performance difficulties (rather than just concentrating on the ones that they understand the best).

In some cases, the root causes of an incident are impossible to identify. When the Root Cause Tree is used to analyze these difficult cases, the failure to identify the root cause is clear because the investigation stops before the lowest level on the Root Cause Tree is reached.

A particular incident's specific root causes identified using the Root Cause Tree are used in the next two steps to identify programmatic causes and to develop/evaluate corrective actions.

Step 7 - Identify Generic (Programmatic) Causes

The specific causes for a particular incident may stem from more pervasive problems - generic or programmatic causes. For example, if a particular incident is caused by a valve not having a label plate, other incidents may occur because of similar valve labeling problems with different valves. Therefore, the investigator needs to look at each specific cause for a particular incident and decide if a more program-wide weakness exists that needs broader corrective action.

Generic causes can be identified by investigating the pervasive nature of the problem. The pervasive nature of the problem can be determined by the investigator's experience, performing a special programmatic evaluation, or by reviewing previous incident statistics.

Correcting generic problems can have a much broader impact on safety, environmental performance, and reliability since they address whole classes of problems rather than just the specific causes of an incident.

Step 8 - Develop Corrective Action

The specific and generic causes that are identified in steps 6 and 7 provide a list of problems that require corrective action implemented in a timely manner. No matter what corrective action is proposed, there is always a chance to somehow circumvent the intent of the corrective action. Therefore, proposing corrective actions for each cause identified (that is, multiple corrective actions) provides a defense-in-depth to preventing the incident from recurring. In some cases, correcting a particular root cause may be too difficult. In these cases, the investigator should ensure that there are sufficient other corrective actions proposed to reduce the likelihood of the incident's recurrence.

If the root cause level was reached in the incident investigation, the corrective actions are usually fairly straightforward to identify. If the investigator could not reach the root cause level, he/she will still need to develop ideas for corrective actions. If the incident has been identified as a repeat of a similar past incident, the investigator should ask if the corrective actions proposed are different from the corrective actions previously tried and why the previous corrective actions failed.

Investigators should work with line management as much as possible when developing corrective actions. They should have thoughtful consideration to ensure the corrective actions recommended are SMART:

S - Specific

M - Measurable

A - Accountable

R - Reasonable

T - Timely

The investigator should develop a Corrective Actions Matrix Table to use in conjunction with the Snap Chart for effective management presentations. The Corrective Actions Matrix should have headings as shown below:

Causal Factors	Root Causes & Generic Causes	Corrective Actions	Responsible Department & Person to Implement	Due Date For Corrective Actions Completion

Step 9 - Report

All of the information and analysis performed up to this point allows the investigator to write a clear, complete incident report describing what happened, why it happened, and what needs to be corrected to prevent the incident (or similar incident), and make effective management presentations. Reports and presentations are extremely important because the case made therein often determines whether the recommended corrective action is expeditiously implemented or is given a low priority and delayed indefinitely.

An important part of incident reporting communication is the Snap Chart. A Snap Chart can be particularly helpful in providing an organized display of what happened and why it happened. When used with the Corrective Actions Matrix described in step 8, these two tools make a powerful presentation of much information in a short time to provide management with knowledge needed to make the best decisions about using resources to improve performance.

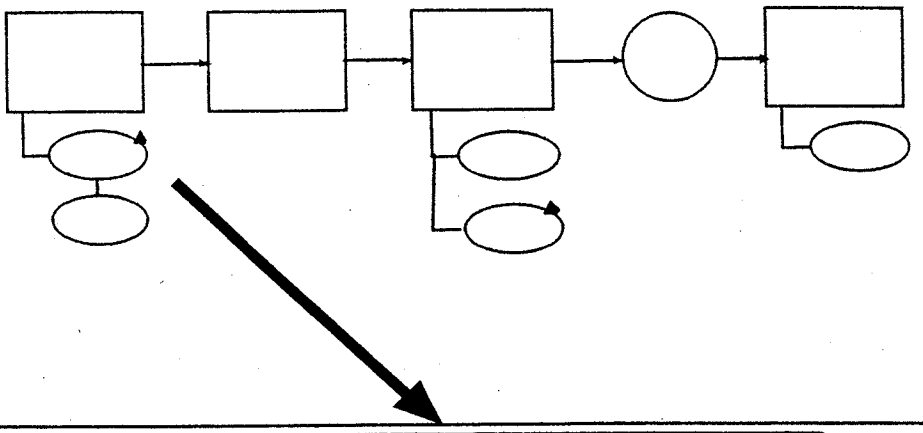
ATTACHMENT

Develop SnapCharT®

Get Started
- Determine what you are investigating

Define sequence of events
- Identify missing or needed information
- Investigate further to find missing information

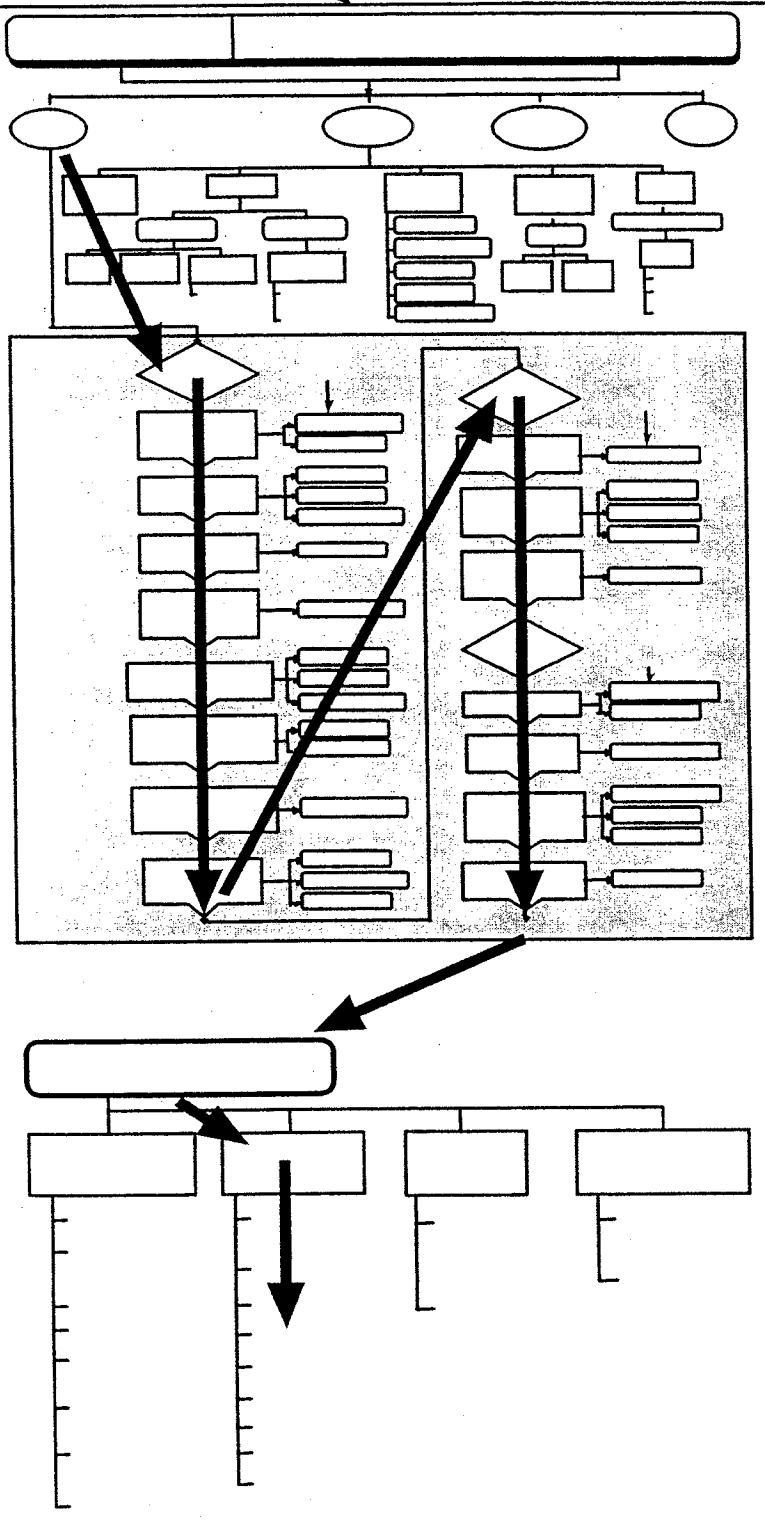
Define causal factors



Root Cause Analysis

Analyze each Causal Factor's Root Causes
- Analyze one Causal Factor at a time
- Begin at the top of the Tree and work through the questions to determine what Basic Cause Categories apply
- Examine **all** of the Basic Cause Categories that apply to determine what root causes apply

Use the *TapRooT® Root Cause Tree® Dictionary* for definitions to all of the questions and root causes on the Root Cause Tree®



NOVARAD
CORPORATION

November 3, 2004

Proposal Summary For:
Utah Navajo Health System – Montezuma Creek
Prices good for 6 Months

Products

NovaRad RAID Level 5, 5-Year On-Site Archive

NovaRad PACS DICOM Server/Router and Telerad Software

NovaRad Dual 2 Mp Color Monitor Clinical Review Workstation

NovaRad Technologist Workstation with Patient CD and DICOM Print

Barcode Scanner (Included)

NovaRad Home Viewer (Included)

NovaStore Emergency off-site back-up (Included)

Connection to CR and US modalities

Kodak CR 500 With DICOM Print and DICOM Store

Kodak CR 500 plates and cassettes (4 – 14 x 17, 4 – 10 x 12)

Software Obsolescence

Installation and Training – 3 days

All Dell Hardware and Maintenance (Included)

Support 24 x 7 (included)

Purchase Price	$98,250
Annual Support (First year free)	$ 5,460

APPENDIX D

TO: DOROTHY KAY CO: DONNA SINGER FAX#: 4356513376

McKesson Medical-Surgical
FX370D -- ORDER CONFIRMATION 8/29/03 10:08:41 PAGE 1
BOCCAGNOE

REF# 00-615389
REP E5 CUST# 046870 P.O.# DONNA SINGER ORDER# 18-621819
ORDERED ON: 01/23/03 GM A/R# 86-06855

SHIP FROM:
McKesson Medical-Surgical
5301 PEORIA ST. UNIT E
DENVER CO 80239
PHONE: 800 525-3000

SHIP TO:
MONTEZUMA CREEK COMM HLTH
CTR/UTAH NAVAJO HLTH SYS
HIGHWAY 262
MONTEZUMA CREEK UT 84534
PHONE: 435-651-3291

VENDOR ABV: MALMED
VENDOR INV: 4187722
TITUS PO: 092431

QUANTITY ORD	SHP	ITEM NUMBER	UM	DESCRIPTION	PRICE	EXTENDED
1	1	S271-00072000	EA	SPIROMETER STARTER KIT W/	1599.00	1599.00
	P-8		1/EA	PRINTER.SPIRM,BASE,AC ADP		

ORDER ITEM COUNT: 1

PO SUB TOTAL 1599.00
TAX .00
PO TOTAL 1599.00

STOCK SUB TOTAL 1599.00
TAX .00
STOCK TOTAL 1599.00

APPROVAL

APPENDIX D